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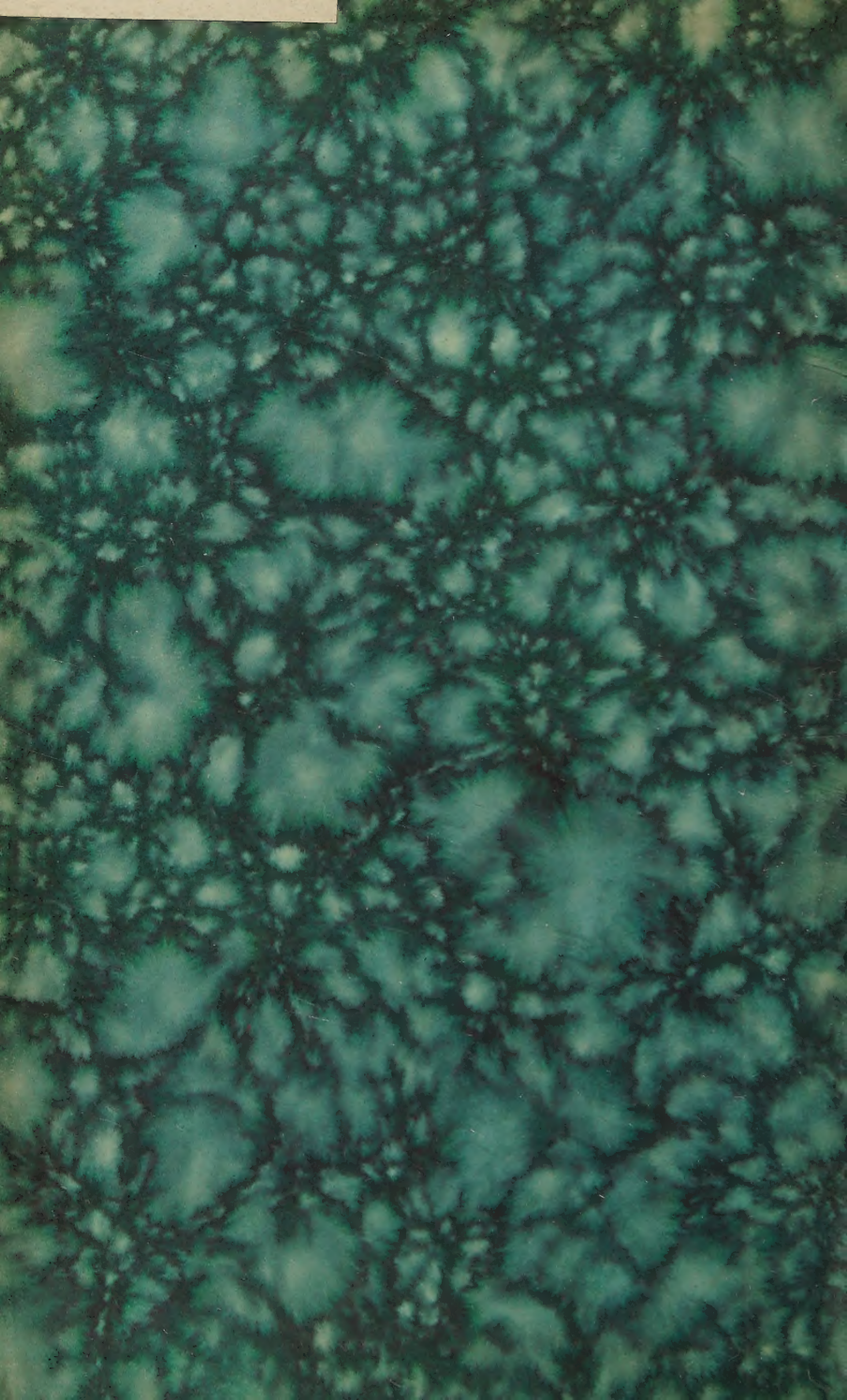

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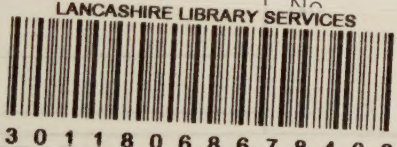

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LIVERPOOL

MODERN COTTON ECONOMICS

BY

THOMAS THORNLEY

HEAD OF THE TEXTILE DEPARTMENT, TECHNICAL SCHOOL, BOLTON; AUTHOR OF "ELEMENTARY COTTON SPINNING," INTERMEDIATE COTTON SPINNING," "ADVANCED COTTON SPINNING," "MIDDLE PROCESSES OF COTTON MILLS," "COTTON WASTE," AND OTHER TREATISES FOR THE COTTON TRADE

WITH SIXTEEN ILLUSTRATIONS

THIS BOOK IS THE PROPERTY OF
THE CORPORATION OF LIVERPOOL

19/12/23

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PREFACE.

As far as it goes this treatise is complete in itself, and does not require a reader to refer to any other volume.

This book, however, is really a companion to the author's treatise on "Advanced Cotton Spinning," and may be taken as Volume II. of that work.

Volume I. comprises two parts, in which Part I. deals with the Machinery and Processes, while Part II. deals with numerous matters, such as Heating, Lighting, Humidifying, Arrangement of Machinery, Treatment of Cotton Waste, etc., etc.

This present treatise deals entirely with the commercial and modern economics side of the industry, and may be taken as Volume II., Part III., of the entire work.

There are not very many calculations dealt with, and scarcely anything of the question and answer style of treatment.

In this treatise very many commercial subjects coming under the administration of a general mill manager or of a mill secretary and salesman are dealt with, but a competent office man needs to go very much further into bookkeeping, various commercial subjects, and general office routine than he is taken in these pages.

Subjects dealt with include transactions in raw cotton, spun yarn, and woven cloth; settlement of disputes, wages lists and methods of payment, conditions ruling the work of operatives, cost of production, ordinary banking procedure, mill shares and partnerships, mill flotation, machinery making, company formation, mill organisation, Manchester and Liverpool Exchanges, trade unions, factory laws, cartels, transport and distribution procedure, Suez Canal, Manchester Ship Canal, etc., etc.

While modern cotton trade problems are mostly dealt with, a little will be found upon the rise and development of the trade.

In spite of imperfections, of which the author is painfully conscious, this treatise is at any rate original, up to date, and designed to meet a demand created by the vagaries of trade largely resulting in one way or another from the great war, the American cotton situation, and the great turn-over of British cotton mills.

The subject of the "Economics of the Cotton Industry" has just become a definite part of the group course in the full curriculum of an advanced cotton class student in England, and the first official syllabus for this is reproduced at the end of the book.

We are also hearing of the "Economics of the Engineering" and other trades, so that more and more attention is being given to this feature of industry.

The author is indebted to several gentlemen for assistance, and their names are mentioned in the context.

THOMAS THORNLEY.

Bolton Technical School,
August, 1923.

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CONTENTS.

CHAPTER I.

PRODUCTION, FIRST TREATMENT, DISTRIBUTION, AND GENERAL FEATURES OF COTTON.

Growing of Cotton—Origin of Cotton—What is Cotton?—Gigantic Cotton Trade—Go-Ahead Oldham—Cotton Localities—Names of Cottons—American "Extras" Cotton—Egyptian Cotton Sub-division—Details of Plant and Fibre—Properties of Cotton Fibres—Cotton Ports and Markets—Foreign Matter in Egyptian Cotton—Crop Rotation—Approximate Cotton Crop—Influence of Rivers on Cotton Growing—The Nile—Assuan Dam—Suez Canal—The Nile Delta—Cotton Ginning—Cotton Baling—False Packing—Approximate Spindles on Egyptian Cotton—Consumption of Cotton—Testing and Pulling of Cotton Fibres—Mechanical Cotton Fibre Sorters—Mill Standards—Arizona Cotton—Microscopical Measurements—Moisture Tests—Sampling of Bales—Cotton Bale Book—Meade Cotton—Climate and Soil—Hard and Soft Cottons—Use of Various Cottons—Occasional Crop Failures—Cotton Weights—Deterioration of Egyptian Cotton—African Cotton—Cotton Mixing—Cotton for Certain Yarns—Cotton Selection—British Research Association—British Empire Cotton Growing—Queensland Cotton—Indian Cotton—Allen Seed Cotton—Chinese Cotton—Mechanical Cotton Pickers—Boll-Weevil—Strength of Fibres . . . . . *Pages* 1-61

CHAPTER II.

COTTON TRANSACTIONS AND MARKETING.

Liverpool Exchange—Liverpool Cotton Association—Cotton Ports—Cotton Importing—Coloured Cotton Growing—Liverpool Cotton Brokers—Sale Conditions—Cotton and Yarn Quotations—Associate Members—Mill Cotton Buying—Light and Shade—Methods of Selection—Cotton Grading—Total Cotton Crop—Terms Given to Cotton Features—Call Cotton—C.I.F. and 6 per Cent. Cotton—Cotton Market Notes—Futures "Tendered"—The Straddle—Hedging—Transactions in Futures—Products of Fine Spinning Mill—Industrial Research—Knitted Goods . . . . . *Pages* 62-86

CHAPTER III.

TRANSACTIONS IN COTTON YARN. MANCHESTER EXCHANGE. SOME FEATURES OF COTTON YARN.

Manchester Royal Exchange—Manchester's Railway Facilities—Manchester Ship Canal—Buying and Selling of Cotton Yarn—Agency Terms—Strengths of Yarn—Yarn Sales—Payments—Counts of Yarn for Certain Cloths—Counterfoil—Appreciated Values—Depreciation of Values—Mixed Orders—Mixed Sorts—Foreign Yarn Trade—Motor Transport—Special Orders—Market Procedure—Notes on Yarn Transactions—Yarn Order Book—Departmental

Books—Yarn Transactions—Manchester Conference Conditions—Cloth Business—Contracts in Cotton Trade—Cloth Contract—Cotton Bill—Yarn Conditioning—Yarn for Specific Cloth Effects—Soft Places in Yarns—Mercerising—Velvets—Some Yarn Defects—Manchester Market—Cloth Finishing—Requirements of Sales—Market Prices—Yarn Contract Note—Metric System—Road Transport—Hosiery—Market Prices . . . . *Pages* 87-122

CHAPTER IV.

USES OF COTTON YARNS. YARNS FOR SPECIFIED PURPOSES.

Some Uses of Yarns—Features of Cotton Yarn—General Cloth Classification—Names of Cotton Cloths—Cleaning Cloths—Sheetings—Satin Quilts—Other Styles of Cloth—Systems in Weaving Mills—Spindles and Looms in Lancashire—Special Kinds of Yarns—Ring Yarn . . . . *Pages* 123-138

CHAPTER V.

OTHER TEXTILE FIBRES. SUBSEQUENT TREATMENT OF COTTON, YARNS, AND CLOTHS.

Other Textile Fibres—Comparative Features of Textile Fibres—To Distinguish Fibres—Tests for Fibres—Paper Yarn Manufacture—Artificial Cotton—Egyptian Cotton—Wool and Cotton Mixtures—Paper Yarns—China Grass—Textile Developments—Finisher's Triumph—Wool and Worsted—Cotton Trade Developments—Application of Cotton Yarns—Dyeing of Cottons—Slubbing Dyeing—Coloured and Grandrelle Yarns—Cotton Waste Yarns for Hosiery—Table for Cotton and Spun Silk—Table for Worsted—Yarns for Specified Purposes—Mercerised Cotton—Cotton Bleaching—Mixture Yarns—Examples of Textile Fibre Uses . . . . . *Pages* 139-159

CHAPTER VI.

COMMERCIAL METHODS. BANKING PROCEDURE. TEXTILE COMPANIES. TRADE UNIONS.

Transport Expressions—Steam Wagons—Rise of Cotton Industry—Partnerships—Cartels—Prime Costs and On-Costs—Bank Charges—Business Documents—Cheques—Stock-taking—Book-keeping—Agents *v.* Merchants—Bills of Exchange—Weekly Report of Spinning Mill—Manchester Shipping Houses—Companies—Amalgamations—Trusts—Circular for Proposed Company—Turn-over—Copyright—Banking Companies—The German Mark—Manchester Publication—Agent—Depreciation—Interest—Discount—Audit—Weather Report—Mill Books—Limits of Association Powers—Share Transfer—Company Articles—Safety of Loan Money—Cotton Mill Shares—Dividends—Costing—Indicators—Cancelled Business—London and Exchange Rates—Appreciated Values—Recapitalisation—Fabric Gloves—Tariffs—Board of Trade Report—Debentures—Machinery Makers . . . *Pages* 160-202

CHAPTER VII.

COST OF PRODUCTION.

The Limited Liability Movement—Size of Mill—Average Counts—Oldham Wages—Low Prices—Indicators—Cost of Production—Calculation—Effect of Raw Cotton Price on Production Cost—Carded and Combed Calculation—Indicator Payment—Calculating Discount and Agency Fees—Second Costing Method—Hosiery Trade—Costings about 1910—Recapitalisation—Overhead Costs—Monsoon Report—Winding Costs—Plain Doubled Yarns—Loan Money—Motor Transport—Pre-War Costs—Variation in Prices—Effect of Twist on Cost . . . . . *Pages* 203-229

CHAPTER VIII.

Wages in Spinning Mills.

Wages in Spinning Mills—Secretarial Examination—Spinner's Price Calculation—Twist-Wheel Calculation—Stretches per Week Calculation—Indicator Calculation—Cash Statement—Bolton and District Spinners' Price List—Reeled Yarn—Weft Standard—Hard *v.* Soft Yarns—Standard Speed—Tubing—Cleaning Time—Bolton Indicator List—Hank Indicators—Oldham Spinners' Price List—Quick Speed Clause—Summary of Cardroom List for Bolton—Strippers and Grinders—Card Tenters—Combers—Slubbing Frames—Jack Frames—Roving Frames—Supplementary Clauses—Definitions—Cop-Packers Agreements—Universal List for Ring-Spinning—Conditions *Pages* 230-263

CHAPTER IX.

Abstract of Factory Acts. Fencing.

Factory Acts—Conference Fencing Laws—Blowing—Room Machinery—Carding Engines—Draw Frames—Speed Frames—Self-acting Mules—Cleaning—General Laws on Fencing—Mill Hoists—Scroll-Shafts and Carrier Pulleys—Duties of Occupiers—Final Grade Examination Paper—Final Grade, Section B, Examination Paper . . . . . *Pages* 264-277

CHAPTER X.

Development of Cotton Trade.

1760-1780—Arkwright & Crompton's Machines—Manchester—London—Cotton Trade 100 Years Ago—Yarn Exports in 1827 and 1853—Welfare Work—Foreign Competition—Cotton in Early Times—Foreign Names for Cotton—Cotton in United States—Ginning—Seed-Cotton—Increase of Cotton Trade—Imports of Raw Cotton in Former Times—Former Transport by Canal—Cotton as a Domestic Industry—Roller Drawing—Early History of Factory System—Machinery Making—Crompton's Memorials—Old Cotton Mills—Watt's Engines—Evolution of the Spinning Machine—Treatises on the Cotton Industry—Welfare Work—Fatigue and Efficiency *Pages* 278-307

CHAPTER XI.

Miscellaneous.

Woven Belting—Raw Cotton Supply—Cotton Research—Cotton "Futures"—Defective Bales—Cotton Growing Developments—Australian Cotton—Egyptian Cotton—Growing Competition—Peruvian Cotton—Dyeing of Cotton Yarn—Uniform Weaver's List—Wages for Winding—Wages for Drawing and Twisting—Burnley List—Rules to Settle Disputes—Other Weaving Mill Lists—Turkish Towels—Cloths in Different Districts—Automatic Looms—Trade Generally—Balance of Trade—Rate of Exchange—Low Grades American Cotton—Faulty Woven Fabrics—Montgomery Quotations—Finishing Operations—Cotton Hair and Cotton Wax—Trading Terms—Air Transport—Lancashire Banking—Manchester Cotton Association—Operative Spinner's Report on Scrotal Diseases—Pre-war Acts of Parliament—Craft Union *v.* Trade and Industrial Unions—Trade Union Acts—Production Costs and Reflotations—First Syllabus for Cotton Economics *Pages* 308-347

Index . . . . . *Pages* 349-354

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CHAPTER I.

THE PRODUCTION, FIRST TREATMENT, DISTRIBUTION, AND GENERAL FEATURES OF RAW COTTON.

Growing of Cotton.

In fixing lines of latitude for growing cotton on a commercial scale, the isothermal method should be followed, in which the lines of latitude should follow the points of equal temperature, either north or south of the equator. Probably seven-eighths of the world's cotton is grown within the limits of 10 to 30° north latitude, since this includes the cotton-growing States of the U.S.A.

A warm, humid atmosphere and ample rainfall are good for growing. Fine weather and plenty of sunshine are beneficial for ripening the cotton and for picking it. Abnormal heat ripens and bursts the cotton pods open prematurely, producing short and irregular cotton fibres. Deficiency of heat keeps the cotton pods moist, restricts development, and produces "Green Cotton." Late frosts kill the young plants. Deep, loamy, soils of a salty and alkaline nature are deemed best. Heavy, clayey soils resist the spread of the plant roots and will not permit moisture to pass, whereas light, sandy or loamy soils give the opposite effect.

Cotton pods probably burst due to increased space required by the cotton as it ripens and dries, and to the ripening and drying of the pods themselves.

In Egypt cotton growing depends a good deal upon the annual overflow of the river Nile and the proper storage and distribution of the Nile waters. In Egypt, the Nile may begin to rise in July and continue to rise until October for the overflow.

Land is prepared in December, January, February; planting in March or April; picking from September onward.

In South America cotton is usually grown in small quantities along with other products. Methods of cultivation are unskilful, fertilisers are seldom used, rainfall is often deficient, but the soil is good.

Origin of Cotton.

For the purposes of nature the fluffy, soft, light cotton fibres serve the purpose of natural propagation of the species since even

seed cotton when first gathered is sufficiently light for a moderate wind to blow hither and thither until the seeds are deposited in some other place either near or far, and fresh cotton plants are thus produced.

The origin of the cotton plant is shrouded in almost as much mystery and old world fable as that of the origin of mankind. It used to be stated that cotton was first grown and used in India, but probably that is only true in so far as the European's first knowledge of it came from the East. In the history of fables it was said that cotton was produced by the "vegetable lamb," a plant animal, or a tree bearing fruit or seed pods, which, when they ripened and burst open, were seen to contain little lambs!

Herodotus, who wrote more than 400 years before Christ, is the first to mention cotton in its Oriental and commercial use. Referring to India, he says: "They possess likewise a kind of plant, which, instead of fruit produces wool of a finer and better quality than that of sheep, of this the Indians make their clothes." Succeeding Eastern writers often referred in one way or another to cotton wool, and hence the origin attributed to India. It is curious, however, that when Columbus sailed westward in search of a different sea passage to India, and came to one of the Bahama Islands, the natives were ready to exchange cotton yarn, and in Cuba the natives were found to be clad in cotton cloth. If cotton originated in the East in India, who carried it to America, or was it blown there owing to its extreme lightness?

Similarly when the passage round the Cape of Good Hope was discovered in the fifteenth century, the inhabitants of some of the African places were found to be wearing cotton cloth of their own making. After all, if we cannot absolutely fix upon India as the original home of the cotton fibre, it is a matter of history that cotton has been grown, and made into cotton cloth for more than three thousand years. The fact also remains that cotton goods are yet particularly well adapted as wearing apparel, and a very large proportion of the inhabitants of India and China are clad almost solely in cotton cloth. We all know that cotton can be spun and woven into very thin durable cloths peculiarly suitable for very hot countries, and the finished cloth can be produced very cheaply, even when ornamented by the use of coloured yarns, by variations in the weave, or by the printing, bleaching, dyeing, and finishing processes. Moreover, the raw cotton, the spun yarn, or the woven cloth, can be cheaply and conveniently transported over long distances, and there is little danger of its going bad if treated with a moderate amount of skill and care.

The present writer has cotton thirty years old in his possession to-day, and it appears to be no worse, because it has been kept dry.

What is Cotton?

Well may the observer ask, when noting the tremendous business connected with King Cotton, what is this article? Cotton (gossypium) is the name given to a vegetable fibre which grows prolificly upon its plants in almost any sub-tropical country or locality in the world. The cotton fibre consists of unicellular hairs mostly from $\frac{3}{4}$ inch to 2 inches in length, attached to the seeds of various species of gossypium, a genus belonging to the malvace or mallow family. The cotton fibres are firmly attached to the seeds which are inside the boll or fruit of the cotton plant. When the cotton pod or boll or capsule is properly ripe, it bursts open and exposes the flossy looping cotton fibres, which almost obliterate from casual view the numerous seeds to which the fibres are attached. The writer has counted thirty or more seeds in one cotton pod, but even in one opened pod of 2 inches diameter there are so very many individual fibres we should not care to have the trouble of counting them. It may be said that cotton pods or capsules grow upon small trees much the same as do apples, only they burst open when fully ripe, and such a good-sized boll is only the size of a very small apple.

A cotton fibre is so very finely constructed—about $\frac{1}{1250}$ inch or so average diameter—that a microscope is needed in order to note the exact details of its construction. Such examinations have often been made by persons interested in the practical spinning, weaving, bleaching, and dyeing cotton, as well as by the interested botanist. Viewed under the microscope a ripe cotton fibre presents somewhat the appearance of a twisted tube, more or less flattened in places, and somewhat irregular in its characteristics in different portions of its length, since some portions appear more twisted than others, or rounder than others, or with the twists running differently. The extremity of a fibre furthest from the seed appears to be bluntly rounded off, with the aperture stopped up.

A cotton operative might be pardoned for answering the question at the head of this paragraph by saying that cotton is the stuff that sticks to his clothes, gets down his throat, gets both inside and outside of him, runs his legs from under him, keeps him in food, raiment, house, coal, and gas; bleaches his face, and controls the whole of his life from birth to death.

Gigantic Extent of Cotton Trade.

The importance of King Cotton is continually on the increase, and more and more it becomes established that cotton is the world's standard article in regard to textiles. If we could commence with the growing of the cotton, follow it from the cotton field to the

cotton mill, witness the many and intricate machines and processes involved in converting raw cotton into finished yarn, thread, and cloth, accompanying these through the equally intricate bleaching, dyeing, printing, and all allied processes, and finally keep company with the finished goods through the warehouses and shops to the users; then, indeed, we could form some idea of the greatness of cotton.

What a tremendous proportion of the world's population is dependent directly or indirectly upon the processes alluded to above, and others that could have been mentioned in the same category! In the early days of public cotton classes in this country—1886 to 1896—it used to be stated that the annual crop of cotton from the United States of America had attained the average of from 6,000,000 to 7,000,000 bales. In that brief space of time this particular country has doubled its output of cotton, and yet the outcry is for more and yet more cotton. There is almost twice as much cotton as there was thirty years ago, and yet the price per pound has distinctly increased. If cotton planters could make a living in 1900, and for the lean years that followed the boom succeeding the Franco-German War, and if cotton merchants and commission agents could do well when prices and monetary turnover were low, then how well must these folks have done during the years of high prices, increasing demand, and large turnovers in weights of raw cotton, cotton yarn, and cotton cloth, with gigantic monetary turnover as a necessary accompaniment!

In round numbers there are to-day probably something like 140,000,000 of spinning spindles producing cotton yarn and more than 30,000,000 of these were added during the period 1900 to 1914, England having contributed a very fair proportion of this total increase. What a very large number of individuals—comparatively small capitalists—have become well-to-do out of the building of new mills in Lancashire, both for cotton spinning and cotton weaving! Truly, there is life in the old dog yet! How many people became comparatively rich in mill turnover days, after the war, and how many poor investors have suffered since!

Go-Ahead Oldham.

Probably no other town or centre in the world has increased its spindleage to so great an extent as Oldham—the home of cotton spinning companies—the almost incredible statistics being that in the period 1900-14 the spindleage in what is known as the Oldham area or province increased from about 11,500,000 to nearly 17,500,000. Compared with this enormous spindleage that of the Bolton area appears very moderate, not now much exceeding 7,000,000, the increase showing up quite small over against other

centres, and much of that being due to outside promoters. No wonder that Oldham is spoken of as a go-ahead town. The difference in spindleage between Oldham and Bolton is still further marked when we consider the average counts of cotton yarn spun in the two centres.

If we take the Oldham standard at 30's counts and the Bolton standard at 60's, then we may assume each Oldham spindle to produce 1 lb. weight of yarn per week, while each Bolton spindle will average considerably below half a pound of yarn per week. Take the Oldham area spindleage at 17,500,000, producing an average of 1 lb. per spindle per week of yarn, allow 10 per cent. of loss from all sources, and a rough idea of the requirements in raw cotton may be obtained.

It may be interesting to add that of the 140,000,000 of cotton spindles of the world nearly half of them are ring spindles, and one-half mule spindles, the number of flyer throstle spindles or other descriptions being inappreciable. In Lancashire there are, of course, many more mule spindles than there are ring spindles, and it will be, in the writer's opinion, a black day if ever the conditions are reversed, and the machine which is tended by women shall oust the grand old mule which finds good work for so many striving workmen. There has always been competition between the intermittent and continuous systems of spinning that existed for centuries in the hand-spinning wheel days, perpetuated by the inventions of Arkwright and Crompton, and is keener to-day than at any previous time.

Cotton Localities.

The Southern States of the American Union may give 60 to 66 per cent. of the total cotton crop of the world, and for the most part this cotton is suitable for most of the ordinary domestic purposes of the average individual. Proportions vary.

Sea Island comes also chiefly from the U.S.A. districts of North and South Carolina, Florida, and the Bahama Islands, but ranks in a class by itself as the best commercial cotton grown and used to a large extent.

Egyptian cotton rules next to Sea Islands in quality, and very much higher in regard to quantity.

Long Staple Uplands, and such as Benders and Peeler's Orleans, rank practically with Egyptian in quality.

The ordinary South American cottons of Brazil and Peru are next to the foregoing cottons in quality, and a limited amount of Peruvian Sea Islands also is grown.

India ranks second in amount of cotton grown, but takes a

lower place than any of the above cottons in regard to general quality.

It is generally stated that cotton cannot be grown for commercial purposes outside the limits of about 38 or 40° north or south latitude, but this does not fully state the position. An isothermal line may be drawn to more correctly indicate the limits of latitude for cotton growing commercially, and cotton can be naturally grown much farther north in some countries than others.

For example, it is stated that 38° north is too cold in the U.S.A. for successful natural cotton growing, but at this latitude cotton could be readily grown in Turkestan, Southern Italy, and Greece.

Names of Cottons.

Market names of cottons are frequently obtained from the places of growth but not always.

Indian Cottons may be arranged in three classes: Bengal, Madras, and Surats. Songs respecting Surats were made in Lancashire during the time of the cotton panic, due to the American Civil War (1860 to 1864), at which time Surats were often used instead of American cottons. Surats still form the largest part of the Indian cotton crop. Surat is a small port in the Presidency of Bombay. One often hears of "Bani" or Hinghunghat cotton as the best of the Indians, but managers have told the author they have found it difficult to find this cotton in Liverpool for many years past, and apparently it was kept back for use in India itself. Other names of Indian cottons are as below given:—Cambodia or Tinnevelly American, Red Coconada—perhaps the deepest coloured of commercial cottons. Northerns, Westerns, Tinnevelly. Above are Madras cottons, and the last-named is perhaps the best. Bengal and Scinde cottons are given as among the worst of Indians. Other Indians—mostly Surats—are: Surtee, Broach, Dhollera, Dharwhar, Oomras, Khandeish, Comptah, Bagalkote.

American Cottons.—It is surprising how few commercial names are quoted for American cotton, considering the large size of the annual crop.

There are: Memphis, Texas, Orleans, Uplands, Mobile, Oklahoma, California, Long Staple Uplands, Boweds, and different varieties of Sea Islands.

There are literally scores and scores of names that are, or have been, used for cottons by the planters themselves and the first handlers of the cotton, in specifying exact local features of the cottons.

For example, there are: Acme, Allen, Alred, Alvarado, Bailry, Bancroft Prolific Barnes, Barnett, Bates Big Boll, Black Seed, Carolina Pride, Colthorp Eureka, Crossland, Crawford Peerless, Elsworth, Griffen, Herlong, Hilliard, Pearce, Peerless, Peelers, Peterkin, Smith Standard, Southern Hope, Tennessee Silk, Texas Wood, etc., etc.

With a very few exceptions such names do not trouble cotton spinners.

For Egyptian cottons modern names are as follows: Sakellarides, which for some years has been the predominant cotton (1921), and is a long and strong cotton. Joanovich, which predominated for some years before Sakel came; Nubari, Assil, Ashmouni, Abassi. The last-named has long been known as a soft white cotton.

American "Extras" Cotton.

These are cottons of extra long staple as compared with average American, say, 1¼ inch upwards.

These may be the result of highly skilled cultivation, careful selection of seed, good climatic and soil conditions.

Among the best known varieties comes "Peelers." A long-stapled uplands cotton of a bluish-white colour, and 1¼ or 1⅜ inch staple, may be used for 60's T. or 80's weft. Another similar cotton is "Allan seed."

It has a white silky appearance, 1¼ to 1½ inch staple, and usable up to as high as 70's or 80's and 100 to 110's weft when combed.

Bender's or Bottom Land cotton, grown in the bends of the Mississippi river is one of the best known of Gulf or Orleans cotton, 1¼ inch staple, usable for 40's to 50's twist, or 60's weft. In parts the Mississippi reaches two miles wide. Formerly it overflowed its banks and made vast tracts of swampy land. High walls have been built in places to contain the waters better, and much of the land overflowed has become the best in U.S.A.

Terms in Cotton Growing.—(1) Breaking up; (2) Bedding up; (3) Fertilising; (4) Chopping; (5) Laying by; (6) Thinning out; (7) Barring off.

Egyptian Fine Sub-division of Cottons.

One of the most expert and the finest sub-division of cottons that ever was made was in the case of Egyptian cotton, under the Cotton Control Commission during the war.

Sub-division of Cotton (Cotton Control Types).

EGYPTIAN COTTON CONTROL COMMISSION'S TYPES (WAR TIME).

Official Values C.i.f. and Spot Terms U.K. also the Commission's Descriptions and Selling Prices F.o.b.

Type No.	Mark.	Alexandria Description.	*F.o.b. $	C.i.f. D.	Spot Terms. D.
		UPPER.			
1	UAA	Fully Good, Extra Staple	46·00	25·41	27·37
2	UAB	Fully Good, Medium Staple	45·00	24·90	26·84
3	UAC	Fully Good, Short Staple	43·50	24·12	26·01
4	UBD	Good, Extra Staple	44·00	24·38	26·29
5	UBE	Good, Medium Staple	43·00	23·87	25·74
6	UBF	Good, Short Staple	42·00	23·35	25·17
7	UCG	F.G.F. to Good, Extra Staple	42·00	23·35	25·17
8	UCH	F.G.F. to Good, Medium Staple	41·50	23·10	24·90
9	UCJ	F.G.F. to Good, Short Staple	41·00	22·84	24·62
10	UDK	F.G.F. Good Staple	41·00	22·84	24·62
11	UDL	F.G.F. Fair Staple	40·50	22·59	24·35
12	UEM	G.F. to F.G.F. Good Staple	39·00	21·82	23·54
14	UEO	G.F. to F.G.F. Fair Staple	38·00	21·30	22·98
15	UFP	Good Fair, Good Staple	38·00	21·30	22·98
16	UFR	Good Fair, Fair Staple	37·00	20·79	22·41
17	UGS	Fully Fair, Average Staple	33·50	19·00	20·51
18	UHT	Fair to Fully Fair, Average Staple	32·00	18·22	19·66
19	UJV	Fair, Average Staple	29·50	16·93	18·28
21	ULZ	Middling Fair, Average Staple	26·00	15·14	16·36
22	UMA	Middling, Average Staple	21·00	12·56	13·59
23	UOB	Low Middling, Average Staple	16·00	10·00	10·84
		AFRITA.			
120	XAA	Sakellarides, 1st Quality	13·00	8·46	9·20
121	XAB	Sakellarides, 2nd Quality	12·00	7·94	8·64
122	XBC	Brown, 1st Quality	12·50	8·20	8·92
123	XBD	Brown, 2nd Quality	11·50	7·69	8·37
124	XCE	Ashmouni, 1st Quality	13·00	8·46	9·20
125	XCF	Ashmouni, 2nd Quality	12·00	7·94	8·64
126	XDG	Mixed, 3rd Quality	10·50	7·18	7·84
127	XEH	Mixed, 4th Quality	9·50	6·67	7·28
		SAKELLARIDES.			
30	SAA	Fully Good, Extra Fine Staple	63·00	34·15	36·76
31	SAB	Fully Good, Good Staple	60·00	32·61	35·12
32	SAC	Fully Good, Fair Staple	58·00	31·57	34·00
33	SAD	Fully Good, Short Staple	55·00	30·04	32·34
34	SBE	Good, Extra Fine Staple	59·00	32·10	34·57
35	SBF	Good, Good Staple	56·00	30·54	32·88

5 per cent. was the maximum which may be added to any of the above prices.

*F.O.B.—Dollars per Cantar, Cash on delivery in Alexandria. 1 Cantar = 99·05 English pounds.

C.I.F.—Three Months' Bank Draft—excluding War Risk.

Spot Terms.—Cash in 10 days, ex Warehouse U.K.

Type No.	Mark.	Alexandria Description.	*F.o.b.	C.i.f.	Spot Terms.
			$	D.	D.
36	SBG	Good, Fair Staple	54·00	29·52	31·80
37	SBH	Good, Short Staple	51·00	27·98	30·14
38	SCJ	F.G.F. to Good, Ex. Fine Staple	54·00	29·52	31·80
39	SCK	F.G.F. to Good, Good Staple	52·00	28·49	30·68
40	SCL	F.G.F. to Good, Fair Staple	50·50	27·73	29·89
41	SCM	F.G.F. to Good, Short Staple	49·00	26·95	29·05
42	SDO	Fully Good Fair, Extra Staple	49·50	27·21	29·33
43	SDP	Fully Good Fair, Medium Staple	48·00	26·44	28·50
44	SDR	Fully Good Fair, Short Staple	47·00	25·93	27·93
45	SES	G.F. to F.G.F. Extra Staple	47·50	26·18	28·20
46	SET	G.F. to F.G.F. Medium Staple	46·50	25·67	27·65
47	SEV	G.F. to F.G.F. Short Staple	46·00	25·41	27·37
48	SFX	Good Fair, Good Staple	46·00	25·41	27·37
49	SFZ	Good Fair, Fair Staple	45·00	24·90	26·84
50	SGA	Fully Fair to G.F. Good Staple	44·00	24·38	26·29
51	SGB	Fully Fair to G.F. Fair Staple	43·00	23·87	25·74
52	SHC	Fully Fair, Average Staple	41·00	22·84	24·62
53	SJD	Fair to Fully Fair, Average Staple	39·00	21·82	23·54
54	SKE	Fair, Average Staple	36·00	20·27	21·85
55	SLF	Mid. Fair to Fair, Average Staple	31·00	17·72	19·12
56	SMG	Middling Fair, Average Staple	26·00	15·14	16·36
57	SOH	Middling Average Staple	21·00	12·56	13·59
58	SPJ	Low Middling, Average Staple	16·00	10·00	10·84
		BROWN.			
70	BAA	Fully Good, Extra Staple	52·00	28·49	30·68
71	BAB	Fully Good, Medium Staple	50·00	27·46	29·60
72	BAC	Fully Good, Short Staple	47·00	25·93	27·93
73	BCD	Good, Extra Staple	49·00	26·95	29·05
74	BCE	Good, Medium Staple	47·00	25·93	27·93
75	BCF	Good, Short Staple	45·00	24·90	26·84
76	BDG	F.G.F. to Good, Extra Staple	46·00	25·41	27·37
77	BDH	F.G.F. to Good, Medium Staple	45·00	24·90	26·84
78	BDJ	F.G.F. to Good, Short Staple	44·00	24·38	26·29
79	BEK	Fully Good Fair, Good Staple	44·50	24·64	26·57
80	BEL	Fully Good Fair, Fair Staple	43·50	24·12	26·01
81	BFM	G.F. to F.G.F. Good Staple	43·00	23·87	25·74
82	BFO	G.F. to F.G.F. Fair Staple	42·00	23·35	25·17
83	BGP	Good Fair, Good Staple	41·50	23·10	24·90
84	BGR	Good Fair, Fair Staple	40·50	22·59	24·35
85	BHS	Fully Fair to G.F. Good Staple	39·00	21·82	23·54
86	BHT	Fully Fair to G.F. Fair Staple	38·00	21·30	22·98
87	BJV	Fully Fair, Average Staple	36·00	20·27	21·85
88	BKX	Fair to Fully Fair, Average Staple	34·00	19·25	20·78
89	BLZ	Fair, Average Staple	31·00	17·72	19·12
90	BMA	Middling Fair, Average Staple	26·00	15·14	16·36
91	BOB	Middling, Average Staple	21·00	12·56	13·59
92	BPC	Low Middling, Average Staple	16·00	10·00	10·84

5 per cent. was the maximum which may be added to any of the above prices.

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C.I.F.—Three Months' Bank Draft—excluding War Risk.

Spot Terms—Cash in 10 days, ex Warehouse U.K.

Egyptian: Quotations for Liverpool Standards.

	Fair.	G.F.	F.G.F.	Good.	Fine.	Ex. Fine.
Official Value Upper . .	20·51	22·98	24·90	26·84	27·37	—
Corresponding Gov. Type, No.	17.	14.	8.	2.	1.	
Official Value Sakel . .	23·54	26·84	28·75	32·30	34·57	36·76
Corresponding Gov. Type, No.	53.	49.	25 pts. over 43.	50 pts. over 36.	34.	
Official Value Brown . .	21·85	24·35	26·01	27·93	30·68	—
Corresponding Gov. Type, No.	87.	84.	80.	74.	70.	

5 per cent. is the maximum which may be added to any of the above prices.

The term "Tal" is short for "Taller" in regard to Egyptian cotton, and is usually equal to a dollar of 4s. 2d. The four best known methods of buying cotton are "Spot," C.I.F., "On Call," "Futures." A person may secure an "option" by paying a certain amount for the right to make a certain cotton transaction in a specified time, if he desires to do so. A "Straddle" consists in selling Futures for one month and buying for a different month.

Details of the Cotton Plant and Cotton Fibre.

Several figures here illustrate the cotton plant, the cotton boll or pod, long views of cotton fibres, cross-sections of ripe and unripe fibres, view of fibre attachment to seed, and relative fibre lengths of various commercial cottons.

After the seeds are sown the young plants may appear in about

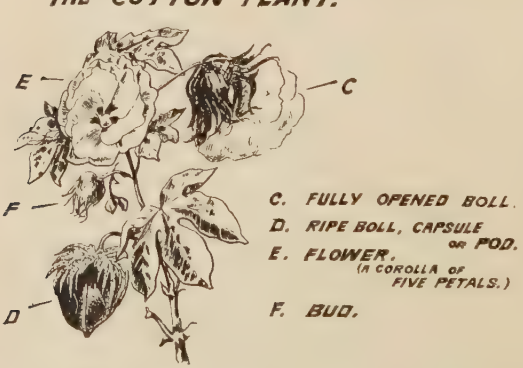

Fig. 1.

eight or ten days' time. During the earlier months of growing, frequent and light rains are beneficial, but in the later stages of growth, or near the fruiting and picking seasons, it is better to have dry days and dry soil.

Possibly seven or eight weeks after planting the seeds, the young buds or bolls begin to show themselves, and about a month later,

the plants may show in flower. From flowering to bursting of pod may take possibly two months.

In the United States of America, the plants may annually attain the height of 4 to 6 feet, during seven months or so, from planting to picking.

There may be thirty-two to thirty-six seeds in each pod, the seeds being attached to the pod, and the fibres attached to the seeds.

Ripe cotton fibres have central apertures, and may be twisted to the rate of possibly 180 per inch in Egyptian cotton, although the twisting factor is very variable.

So-called natural twist is peculiar to the cotton fibre and helps the fibres to interlock and adhere to each other and give a sufficiently strong yarn.

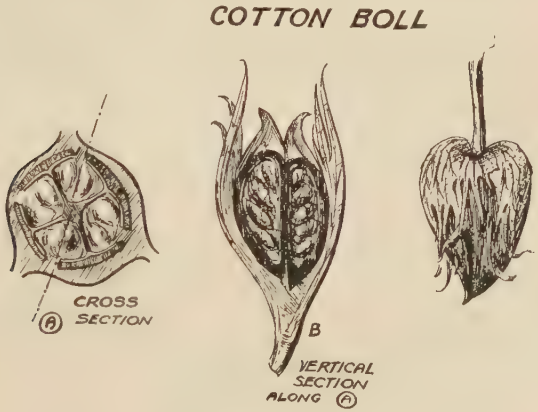

FIG. 2.

Dr. Bowman says: "A typical cotton fibre is a long tubular compound vegetable cell, from 1,200 to 1,500 times as long as it is broad." Ripe cotton fibres have a more or less irregular by round section. Unripe fibres are flat.

Properties of Cotton Fibres.

Natural twist is the most important of the features which render cotton so eminently fitted to hold commercial supremacy amongst other textile fibres. If, for instance, flax were cut to the same length as an ordinary cotton fibre, it would be difficult to make the fibres adhere to each other, although there is no difficulty experienced with the cotton fibres. Nay, further than that, they have a strong natural tendency to stick to one another because of this natural

twist. As to its extent and cause, we dealt with the matter in "Elementary Spinning." A quality which—although not physical—undoubtedly has a great deal to do with its commercial supremacy, is the ease with which it can be cultivated and the lowness of its price per pound when compared with other fibres. Allied to this point

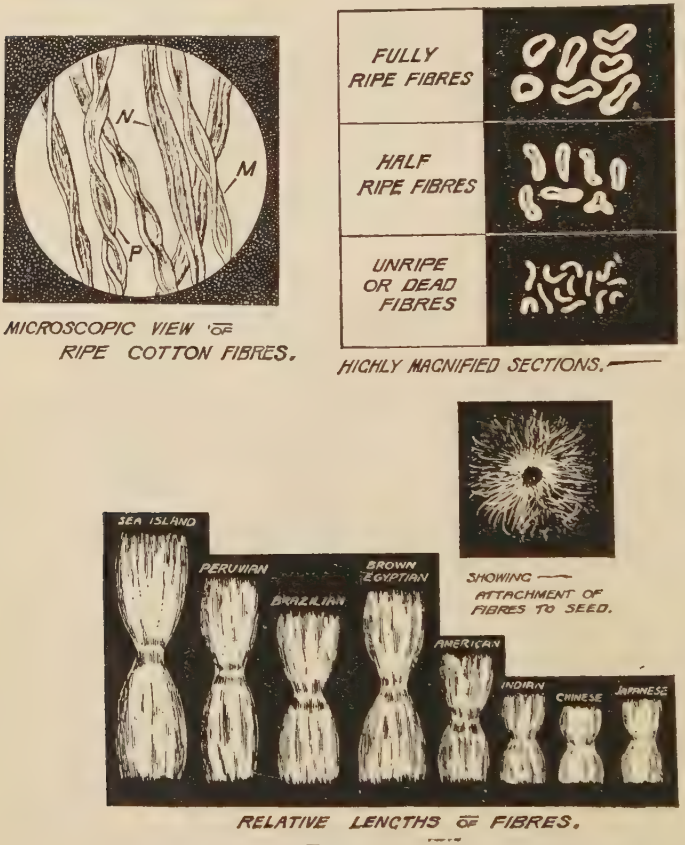

Fig. 3.

is the quality which it possesses of readily blending with other and higher priced fibres, such as silk and woollen, in such a manner that it is often difficult to detect the presence of cotton in mixed goods. This admixture and imitation are greatly facilitated by the quality of colour which it possesses, and the ready manner in which it can be satisfactorily treated by polishing, bleaching, and dyeing

processes. The hollow character of fully ripe fibres is a quality which greatly aids in the latter process, although we might place before it, in order of importance, length of fibre and fineness of fibre. These two qualities, combined with natural twist and the qualities of strength and elasticity, are the features which more especially enable us to make the millions of miles of long fine cotton, yarn or thread that are annually produced in the world. Other qualities are evenness and smoothness of fibre and natural moisture and pliability, all of which assist in the production of cotton yarns out of the raw material.

Cotton Ports and Markets.

The geographical position of Liverpool, its shipping facilities, its nearness to the English cotton spinning and weaving centres, the land transport facilities, and the work of the Liverpool Cotton Brokers' Association, have obtained and maintained supremacy of Liverpool as a cotton port and market since about 1800. Liverpool has long been the largest spot cotton market in the world, and the rapid increase of cotton spinning and weaving in America, the efforts of the Manchester Ship Canal Co., tranference of some shipping to other ports, have not yet deposed this city from its long established supremacy.

The author has personal knowledge of important spinning firms which now send out their own representatives to America or Egypt in July or August to buy cotton on the spot or obtain first-hand information, thus following a long established custom of cotton importers and merchants. Purchases ahead may be covered by Futures transactions to diminish risk. Importers may sometimes purchase from type samples and by means of cabling.

Cotton may be bought from Liverpool by the medium of a broker sending small samples to the spinning mills. The samples may be called "averages," and the spinner selects from these and does his buying by 'phoning or wiring to Liverpool, spot cotton terms. This system obviously has its limits.

The $\frac{1}{2}$ per cent. commission paid by spinner to buying broker, or paid by merchant to selling broker, is charged on the gross value of the cotton.

Liverpool has been the most important British cotton market in the world almost from the first beginning of the modern factory system, largely inaugurated by the inventions of Kay, Arkwright, Crompton, and Hargreaves, just nicely prior to the year 1800. For a short time London was the premier cotton market. Numerous cotton broker's and cotton merchant's offices are assembled in a small area in Liverpool.

Since the *Manchester* Ship Canal was opened, a decade or so

before the present century opened, Manchester has gradually increased in favour as a cotton port, and now in 1922 it carries a good weight of cotton.

Havre, on the river Seine, in France, is probably the principal cotton market for that country.

Amsterdam serves for Holland.

Bombay is the principal cotton port and cotton market in India.

Alexandria is the chief port and market for Egyptian.

Yokohama for Japan, and Shanghai for China.

New York is the chief cotton market for the United States of America, but a large amount of business is done—especially in actual spot transactions and C.I.F. cotton—at such places as New Orleans, Galveston, Charleston, Houston in Texas, and other southern places.

There are centres for cotton transactions also in South America.

Foreign Matter in Egyptian Cotton.

From time to time cotton mills using Egyptian cotton have had occasion to complain of "foreign matter" such as jute, string, canvas, etc., being found in bales of Egyptian cotton, and the serious trouble that this occasions at the mill to managers and operatives. A number of mills have made complaints to the Manchester Cotton Association in regard to the finding of "foreign matter" in the bales, and have also sent samples thereof to the Association. The pieces are very small.

As a result, the Manchester Cotton Association addressed a letter on this subject to the Alexandria General Produce Association, strongly deprecating this practice, and urging that most drastic steps should be taken by the authorities to prevent "foreign matter" getting into the bales. The president emphasised the damaging effect that this has upon the yarn and the dissatisfaction caused to the workpeople. A letter was received from the president of the General Produce Association at Alexandria :—

"We have received several parcels from you containing foreign matter found in the bales of Egyptian cotton in the spinning mills.

"We have not failed to draw the attention of the baling companies to this, asking them to take the necessary care.

"It appears from enquiries made, that the foreign matter in question was in the cotton when it arrived at Alexandria, from the time of gathering and after storage in the ginneries in the interior. The trading exporters of our place are doing everything possible to make a search, and to avoid this strange matter here, where they are able to exercise more control than in the ginneries.

"Unfortunately in a great number of ginneries the trading members of our Association are unable to exercise any control.

Nevertheless, we often send circulars to the proprietors of all the Egyptian mills to take up the grievances of the spinners, and to ask them in their own interest and in the interest of the country in general to do their utmost to avoid a repetition of these faults."

Fan Hole Dust and Droppings.

There has long been an idea in this country and others that dust hole dirt and worst droppings were good for land fertilising. Thousands of loads have been taken by farmers under this impression.

In certain cotton States in America, cotton farmers did this on a large scale, but were very dissatisfied with results. Samples submitted to the State chemist for analysis were quite against such refuse being of value as a fertilsier.

Crop Rotation. American Cotton.

Cotton does not make excessive demands upon the soil, but it is a clean culture crop, i.e. it is all taken out and therefore it adds no humus to the soil, so that its continued growth will wear out even the richest delta lands. Crop rotation with the growing of a leguminous crop such as cow-peas in the corn after the small grain rotation is the most satisfactory way of renewing the vitality of the soil. Of course all lands will be benefited with some fertiliser, it hastens maturity on bottom lands and increases the yield on poor uplands.

The rotation system is the only proper way of growing cotton.

Triennially, an equal farm area is devoted to each of the three staple crops, cotton, corn, and oats. The best third is planted into cotton, the next best in corn, and poorest third into fall oats. Each of these crops when planted is given its own specific fertilisation.

APPROXIMATE COTTON CROPS.

Given in Round Numbers in Bales all taken at 500 lb. each.

Season.	America.	India.	Egypt.	Russia.	China.	Other places.	Total.
	Millions.	Millions.	Millions.	Millions.	Millions.	Millions.	Millions.
1910-11	$12\frac{1}{5}$	$3\frac{4}{5}$	$1\frac{1}{2}$	$\frac{9}{10}$	$1\frac{4}{5}$	1	$21\frac{1}{4}$
1911-12	16	$3\frac{1}{4}$	$1\frac{1}{2}$	$\frac{9}{10}$	$1\frac{4}{5}$	1	$24\frac{1}{2}$
1912-13	$14\frac{1}{5}$	$4\frac{1}{5}$	$1\frac{1}{2}$	$\frac{9}{10}$	$1\frac{4}{5}$	$1\frac{1}{8}$	24
1913-14	$14\frac{2}{5}$	$5\frac{1}{5}$	$1\frac{1}{2}$	1	2	$1\frac{3}{10}$	$25\frac{1}{2}$
1914-15	15	$5\frac{1}{5}$	$1\frac{1}{5}$	1	2	$1\frac{3}{10}$	$25\frac{9}{10}$
1915-16	13	$3\frac{4}{5}$	$\frac{10}{11}$	1	$1\frac{3}{4}$	$1\frac{1}{10}$	$21\frac{7}{10}$

Possible places for cotton growing or increasing same, or places where moderate quantities are, or have been, grown, are: East Africa, West Africa, the Soudan, West Indies, Russian Turkestan, Japan, the Isles of the Levant, China, Fiji, Tahiti, Queensland, Uganda, Mexico, Peru. Much more could be grown in the U.S.A., if deemed sufficiently profitable, or in India, if production methods and facilities were increased.

Influence of Rivers on Cotton Growing.

Rivers play an important part in the production and early transit of raw cotton.

Of these rivers the Nile for Egypt and the Mississippi for America stand pre-eminent.

The Nile rises in the Abyssinian Highlands, and mountains, and inland African lakes; has its final outflow in the Mediterranean Sea, and has a length of 3,600 miles, being exceeded in length only by the Amazon, which is 4,000 miles long. Approximate lengths.

The Mississippi is the fifth longest river in the world, with a length of 3,160 miles.

It flows through the cotton states of the southern part of the U.S.A., has its outlet in the Gulf of Mexico, and has a great influence on the production and early transit of much American cotton.

The Missouri is a second tremendous U.S.A. river, flowing into the Mississippi, after running for 3,000 miles.

The Arkansas river of 2,000 miles length, also has its outflow in the Mississippi, and this may give some conception of the mighty Mississippi river at its greatest.

The cotton belt of U.S.A. covers 24° of longitude and 10° of latitude. The cotton growing area of the U.S.A. represents about 600,000 square miles.

The great Mississippi river, turned from a south-easterly course, divides the cotton belt into western and eastern portions nearly equal in size.

The Nile.

The Nile dam and irrigation works at Assuan and Assiût were completed in 1902, and since then comparatively little difficulty has been experienced in obtaining sufficient water for irrigation. Previously the risk of failure was great. The annual overflow of the Nile waters take the place of rain, which seldom or never falls in this part of Egypt. The Nile may begin to rise in July and reach its highest in October, and much depends upon the efficient control of the water. Melting of snow and heavy rainfall near the sources of the Nile cause the overflow. The muddy deposit left by this overflow

is supposed to have provided a grand soil for cotton growing, and although the restrictions of the overflow may be worse in this respect, yet the careful storing of the waters should more than compensate.

The Blue and White Nile join near to Khartoum and constitute what is termed the Egyptian Nile. From Khartoum to the Mediterranean is about 3,000 kilometres in length, and receives a tributary, the Atbara.

The Blue Nile and the Atbara have their sources in the Abyssinian mountains, while the White Nile has its origin in the large lakes of Central Africa.

The Blue Nile and the Atbara may be in flood from August to November, flow quickly, and carry much soil from the Highlands of Abyssinia, where, owing to the heavy fall, the water does not soak into the soil.

The White Nile rises in early summer and flows slowly through marshes, carrying a large amount of vegetable matter, such as, pieces of roots of grass from the marshland, while the Atbara and Blue Nile carry a great quantity of mud and silt.

It has been stated that it is this deposit of silt and mud for thousands of years, which has formed the Nile delta.

In Egypt there is practically no rainfall, and the country depends for its water upon the river Nile.

By the former basin irrigation system, the country is banked up into large plots, which were flooded by the Nile; beginning about the middle of August, and ending just before the end of September.

In Lower Egypt there is no basin irrigation, the water going into numerous canals at flood-time. In summer, when there is a limited supply, the water is stopped by the great barrage 12 miles below Cairo and distributed to required irrigation areas.

Each main canal supplies smaller ones which are again subdivided for the water to run to almost every point in the delta. From September to April there is a plentiful water supply, but from May to August the water is given out in rotation on a rationing basis.

A gigantic storage reservoir has been constructed at Assuan and a barrage at Assiût, and these works practically guarantee the water supply during the dry summer months, especially in the basis of Upper Egypt.

The Assuan Dam, constructed by John Aird & Co., has a height of 166 metres and a length of 2,000 metres. There are many sluices to be opened or closed as arranged. At the beginning of December the floods cease, the sluices are closed and it may take fourteen or fifteen weeks to fill the great reservoir. About the end of April the Nile becomes too low to feed the linked-up canals, and from that period the Assuan storage water may be used.

Although the irrigation system has been so highly developed it is considered that land draining facilities are insufficient, and there is consequent water logging in parts, giving deterioration in quantity and quality of cotton or other produce. In Upper Egypt there is a natural and efficient drainage.

In Lower Egypt are: Cairo, Alexandria, Damietta, Ismailia, Port Said, and Suez.

In Upper Egypt are: Assiût, Aswân, Beni-Suef, Fayyûm, Gizeh.

Suez Canal and Egypt.

The Suez Canal has been of the utmost service in the importation of Indian raw cotton, in the export from this country of cotton yarn and cloth to India and China, and in permitting the quicker passage of both goods and persons between the far East and the countries of Europe. The British Government purchased in 1875 a large number of shares in the Suez Canal representing a very strong interest. This Canal was opened in 1869, has a total length of 101 miles, and a width of 147 feet 8 inches or 45 metres.

Maximum draught of water allowed for vessels is 30 feet or 9·14 metres.

Average time for transit through the Canal is 16 hours 28 minutes.

Management entrusted to thirty-two administrators of whom ten are British.

In 1914, 4,802 vessels passed through the Canal, representing nearly 20,000,000 of tons net., the British percentage being 66½ of the total.

Cairo is the capital of Egypt, and stands on the east bank of the Nile about 14 miles from the head of the Delta. Population above three-quarter million.

Alexandria was founded 332 B.C. by Alexander the Great, and was for a long time the capital. It is the great Egyptian Cotton market and port. Population almost 450,000.

Cairo is 2,520 miles from London, and can be reached via Marseilles in six days.

Egypt takes the north eastern part of the African continent, and the Peninsula of Sinai in Egypt, but the term is more strictly applied to the Nile valley.

The importance of Egypt arises mainly from two features: (*a*) It is the connecting link of the roads between East and West. (*b*) It has an abundant and regular water supply from the Nile river.

The part north of Cairo is termed Lower Egypt, and the part

south of Cairo is termed Upper Egypt. A north wind prevails almost all the year round and is beneficial.

With a growing population, Egypt's great source of income arises from agriculture, of which cotton is the chief export, but other articles are important such as barley, rice, beans, maize, wheat, sugar, dates, and nuts.

Egyptian Cotton—The Delta, The River Nile, The Sudan.

The climate is practically rainless, the annual rainfall being only about 1 inch in Cairo, although somewhat more at Alexandria nearer the sea.

Cultivation of cotton is restricted therefore to the comparatively narrow limits to which the Nile waters may be distributed. This district consists in the first place of a strip 550 miles in length, but sometimes not much more than a mile wide on either side of the Nile, reaching from Cairo to Assuan.

In the second place there is the celebrated Delta of the river Nile reaching from Cairo to the Mediterranean Sea. The best cottons are grown in the Delta and indeed 75 per cent. of the total crop.

It is stated that the Delta makes a sort of triangle of which the sides represent about 120 miles, and the coast-line or base of the triangle extends about 70 miles along the Mediterranean.

Long staple cotton has been more or less cultivated in this Delta for about 100 years.

Systems of canals were shortly constructed, while the Cairo or Delta barrage was first completed in 1861, abandoned through collapse in 1867, repaired by 1890. Similar barrages were later constructed for Upper Egypt at Esna and Assiût.

Still later came the great Nile Dam at Assuan which is filled from tail end of the annual flood, kept nicely full through the autumn and winter until the beginning of water shortage in March or April of following year. An official report suggests that the *Sudan* is likely to become one of the greatest cotton-producing countries in the British Empire and goes on as follows :—

" The geographical area of the Sudan is larger than that of Egypt. It is about 1,000,000 square miles in extent or about half as large again as the American cotton belt. The climatic range is much greater than in Egypt, especially with regard to rainfall, so that a large proportion of the country—not all—may ultimately become suitable for cotton growing."

Cotton Ginning.

Ginning is done as soon as convenient after picking, and as near as convenient to the plantations, although a final packing is

sometimes done at some distance away. Approximately two-thirds of the total weight of seed cotton consists of seeds, which have obtained a good market value for oil-extracting, cattle food, and fertilising. Cotton seed oil is largely used in the preparation of articles of food. The saw gin is mostly used in America and for short staple cotton, while the Macarthy roller gin is preferred for such cottons as Egyptian and Sea Islands, as being less likely to damage the fibre, although much less productive than the saw gin. (For illustrations of gins, see "Elementary Spinning."

The cotton seed opener is a machine sometimes used for treating the seed cotton before ginning. The seed opener loosens and opens out the seed cotton so that the gin can increase both the quantity

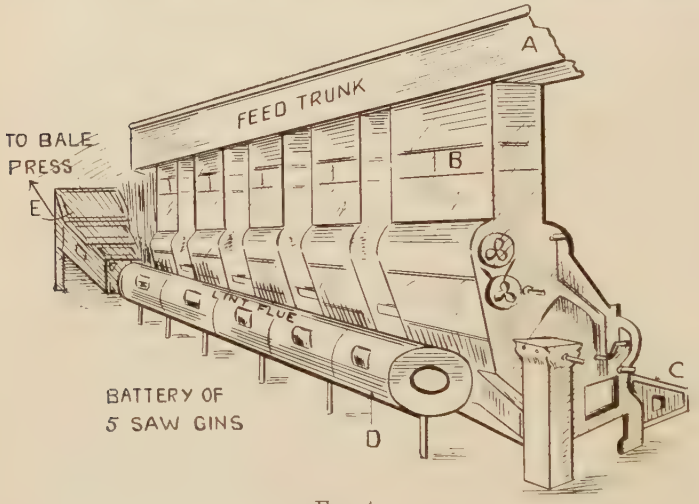

Fig. 4.

and quality of lint or ginned cotton. It consists essentially of cylinder for opening, feed and delivery lattices, and a fan arrangement for taking away the liberated dirt and dust.

For dealing with large quantities of seed cotton batteries of gins are sometimes used, in which several separate gins of similar character, are combined into one powerful arrangement, having one feed and one delivery arrangement. The seed cotton may be lifted from the plantation cart, carried automatically through all the processes, and finished off as a compressed bale. After the seeds and cotton have been separated, there are lint flues and condensers for the lint or ginned cotton, hoppers and conveyors for the seeds and suitable dust and air chimneys.

Cotton Baling or Assembling.

For the purposes of transit it is customary to assemble cotton into compact, heavily pressed bales, very powerful steam or hydraulic presses being used for the purpose. Naturally, in the lapse of years, the methods of cotton baling have shown a certain amount of improvement in common with all other processes connected with the cultivation, transhipment, cleaning, and spinning of cotton. Generally speaking Egyptian and Indian bales have been more closely packed than those from America.

Baling Presses.

Formerly screw presses were in common use in the Southern States of the American Union. There was a large wooden screw,

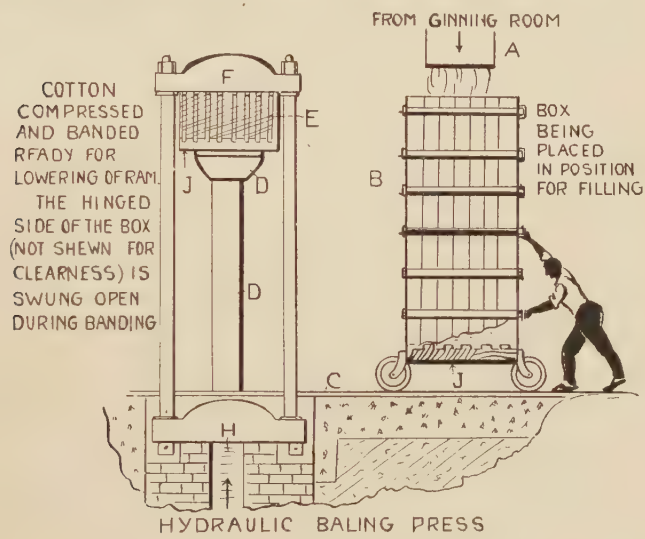

Fig. 5.

working in a suitable wooden nut, supported by a frame, in which the receiving box for the cotton was built. The screw was operated by mule power applied to long levers secured thereto at the top. The seed cotton was carried about by hand. The ginned cotton was carried to the screw press by hand, and the whole process was so slow and cumbersome that only a very few bales of cotton could be ginned per day.

The bale of cotton as made on the old plantation screw press, and in common use until the end of the civil war and the early '70's,

was about 66 inches long, by 24 inches thick, and 30 inches wide, covered with jute bagging, and securely bound round by hempen ropes. Frequent treading or tramping down by the men about the press was made to help the work of the screw in obtaining reasonably compact bales.

Such crude methods as the above have given way to the employment of very powerful steam or water-power presses, but may be occasionally employed at distant plantations as a preliminary process for transporting the seed cotton to the ginning house, and of the loosely packed lint to the baling house. The modern machines for compressing the cotton into the compact bales of cotton that reach our Lancashire mills are very powerful indeed, and usually the cotton before reaching these may have been treated by the wooden screw press or even water press of moderate power. Railroad companies, and large cotton export companies may have enormous compresses at the large inland towns such as Houston in Texas, or seaport towns such as New Orleans.

It is stated that pressures are applied by these compresses varying from 1,000 to 3,000 tons. An American bale could be pressed into a thickness of 6 inches, or 8 inches by such a machine, although after leaving the press it would double its thickness. It has been estimated that the Morse press can exercise a pressure of 6,000,000 lb. upon a bale of cotton. It remains to be seen what can be done with electric presses.

In the water-power press there may be two press boxes in use at the same time, one being filled with cotton while the other is being used. When a filled box of cotton has been placed inside the press for treatment, the cotton may be almost a dozen feet in depth when the ram is at the bottom. After the ram has reached its maximum height the bulk of the cotton may be only one-fifth or one-sixth the above dimensions, and while under the press action the jute covering may be fastened on by the iron bands.

Markings of Cotton Bales.

It is well known that the bales of cotton when reaching our Lancashire mills have various markings or stampings upon them. These are generally more in the nature of identification marks rather than an indication of quality. Labels and tags may be attached to the bales, and the bales may be stamped with letters or numbers which serve as a means for the initiated to trace the exporter, the agent, the ginning and baling house, or even back to the cotton planter himself.

The marking serve only to indicate quality, inasmuch as bales of a certain lot may have the same identification marks, and they

scarcely serve the same purpose as they would if the gradings or stapling of the cottons were indicated.

Three Leading Types of Cotton Bales.

The Southern States of the American Union produce five-eighths of the world's cotton, India is easily the second largest producer of raw cotton, while Egypt is easily the third in order of quantity, and it beats either of the other two in quality.

Naturally the weights of the bales of cotton from the same country vary in weight, but as a general average the following weights are somewhere near the mark :—

Egyptian bales . . .	740 lb. average.
American bales . . .	500 ,, ,,
Indian bales	400 ,, ,,

The Egyptian Bale.

It will be seen that the average weight of the Egyptian cotton bale is much greater than any other, and it speaks well for the character of the presses and those in charge. It may be stated that it is a frequent practice in Egypt to pack the cotton to only a moderate extent at or near the plantation, and then to carry out the real work of baling for shipment at the great Egyptian port of Alexandria. This concentration of the work, fostered by the desire to reduce the dimensions of the cotton package so as to get the full benefit of the ship's ton method charging for freight, have a great deal to do with the heavy weight of Egyptian bales. As an accompaniment of the heavy bale, it is customary to fasten eleven steel bands around the jute covering of an Egyptian bale, whereas seven bands of ordinary iron are considered sufficient for an ordinary American bale. All this facilitates the transhipment of the cotton from Alexandria, along nearly the full length of the Mediterranean Sea, through the Straits of Gibraltar, and thence to our English ports of Liverpool or Manchester. The weight of 740 lb. or so of Egyptian cotton is compressed at Alexandria into a compact bale possibly 23 inches thick, 33 inches width, and 4½ feet in length, suitable for a long sea passage.

The Indian Bale.

Remembering that it is 6,000 miles or more from Bombay to Liverpool, even by the shortened route of the Red Sea and the Suez Canal, it is natural to expect that bales of Indian cotton shall also be heavily compressed. The ship's ton method of calculating freight charges by cubic space occupied is certainly remembered in baling

Indian cotton, and as the weight per bale may only average 400 lb., the bales are much smaller than Egyptian, reaching something like 17½ to 18½ inches thickness, 2 feet width and 4 feet in length. Indian cotton packs somewhat heavily, and its density per cubic foot in the bale is not usually smaller than any other.

In regard to the ordinary type of bale there has been an immense amount of controversy, and there have been numerous attempts to supersede this by round bales of various descriptions, and requiring special presses for their preparation. The rectangular type of bale is, however, still the usual thing for American as for the other cottons. There is probably more variation in total weight of bale, in thickness, width, or length, in the case of American bales than with any other, and this in spite of the fact that American cotton occupies such a predominant position, and the people associated with the planting, ginning, and baling of cotton are supposed to be more expert in America than anywhere else.

It has long been true of American cotton that the jute covering is of a very coarse texture, and the bales regularly reach the cotton mill in a very dilapidated fashion, calculated to increase risk of fire damage, and to subject the cotton unduly to the risk of "country damage."

Generally speaking, Egyptian cotton is pressed three times. First when the cotton comes from the field the grower puts it into sacks of about 400 lb. After ginning, it is made up into hydraulically pressed bales of about 700 to 800 lb. each. For this purpose box presses are used; two or three boxes on a turning disc; while one bale is pressed the other is getting ready. Finally, there is the Alexandria baling for shipment.

Final Baling for Shipping.

South American cotton bales from Brazil or Peru, are usually lightly pressed owing to transport difficulties or want of proper presses. A typical bale may be about 220 to 250 lb. weight, lightly bound with wire or willow banding. Sea Island cotton is often packed in large unpressed or lightly pressed bales.

In regard to round bales of American cotton, it has been claimed they are better for carriage, less liable to fire or to country damage, minus hoops or metal of any kind, but slow progress has been made with their adoption.

Packing of Cotton Bales.

Claims for over-taring and wrong allowances for bands are avoided as much as possible by many spinners. High-priced cotton, however, makes losses due to these items a greater source

of loss, while moisture in tares and patching of tares sometimes lead to a spinner paying for cotton and only receiving tare.

The allowance for tares on American cotton is 4 per cent. and may be tested by storing the tares from a specified number of bales, and later on comparing actual weight of these tares against the weight put down in the invoice.

Warm storage in a spinning mill is of course likely to dry up the tares and give a lighter weight than at Liverpool, and this must be considered in any claim.

Hard patches sometimes found in the centres of American bales have been ascribed to the addition of water during baling. It is sugge-ted that water is thrown on the cotton in the press when a bale is half made, and then the bale is finished off. The result is a hard patch of cotton—sometimes stained or mildewed—in the centre of the bale, of very little value to the spinner.

In order to make a claim for such unmerchantable or "bump" cotton, it may be bagged up in its own wrapper with identification marks sufficiently clear. By arrangement this may be sent back to Liverpool and allowances obtained on prices that day ruling.

It has been suggested that in other cases of water adulteration the water is added in the form of a small spray. Over-conditioning in this manner may produce hard caky flakes of cotton in the bale.

The Appeals Committee of the Liverpool Cotton Brokers' Association selects each season standard samples of cotton, which remain under the charge of the Association Secretary, and are used for reference in arbitration cases.

There are many people who consider that more uniform standards and arrangements for raw cotton might be made before cotton reaches Liverpool or Manchester. The bale itself could become more uniform in tare, shape, dimensions, weight, and make-up; over-taring added moisture, markings the exposed cotton itself, heavy and badly made patches.

Tare now often gets damaged by forcing the bales of cotton in and out of lorries, ships, and railway wagons. Bales could be made up better to facilitate sampling.

Cotton appears to have become permanently much dearer than pre-war so that the monetary losses due to painted marks on exposed cotton in the bale, to bag pickings and to "country damage," are now proportionately higher than formerly.

False packing of cotton is occasionally resorted to, in which the sides of a bale may be of cleaner or better staple cotton than the interior. Claims may also be made for "false packs."

Discounts.

In September, 1902, the Liverpool Cotton Brokers' Association adopted the decimal system, in which a point became $\frac{1}{100}$ penny instead of $\frac{1}{64}$. The $1\frac{1}{2}$ per cent. discount hitherto allowed was discontinued and also the 2 lb. per bale D.D. or double draft allowance.

Those changes were resented by spinners at first, but have long since become standardised, and have the effect of making book-keeping somewhat more simple. Attempts to stop the allowances or discounts on yarn and cloth have hitherto failed, partly because neither spinners nor weavers have the same strong unity in their associations.

The figures in the three following tables were returned to the International Federation of Master Cotton Spinners, pre-war. They are intended to form a basis for study and reference. Such countries as Japan, India, and America, increased their spindleage somewhat, due to the effects of the Great War, while European countries somewhat suffered. Russia especially suffered. For very exact, up-to-date figures readers must refer to the latest statistics annually collected by Mr. A. Pearse, the very able secretary.

APPROXIMATE SPINDLES SPINNING EGYPTIAN COTTON, 1912.

England	14,000,000	spindles
Germany	1,400,000	,,
France	1,400,000	,,
Switzerland	875,000	,,
Russia	800,000	,,
U.S.A. (conjectural)	600,000	,,
Austria	500,000	,,
Italy	250,000	,,
Japan	212,000	,,
Spain	100,000	,,
India	21,000	,,
Egypt	20,000	,,
Belgium	6,000	,,
Sweden	6,000	,,
Total	20,190,000	spindles.

It is a rule that—

"The stock of cotton in Liverpool shall be taken at the following periods—viz. at the end of February and at the end of August."

Testing Cotton Fibres for Length.

We never attain to the *desirable ideal* of having raw cotton with all its fibres equal in length, but some spinners have improved their

CONSUMPTION OF COTTON FOR YEAR ENDING 31st AUGUST, 1912.

Countries.	Number of Spinning Spindles in Work. Actual Returns.	Consumption in Actual Bales.					Total World Estimated Number of Spinning Spindles.
		American.	East Indian.	Egyptian.	Sundries.	Total.	
Great Britain	48,733,945	3,289,976	39,957	329,957	105,708	3,765,462	55,317,083
Germany	10,562,082	1,375,694	224,116	106,836	63,640	1,770,286	10,725,732
Russia	7,769,907	545,831	18,369	72,251	1,398,628	2,035,079	8,800,000
France	7,146,810	804,516	82,538	73,727	27,062	987,843	7,400,000
India	4,415,588	79,552	1,524,032	1,052	1,915	1,606,551	6,195,214
Austria	4,797,935	644,812	162,373	33,543	23,368	864,096	4,797,935
Italy	3,623,064	616,162	161,842	21,245	13,511	812,760	4,580,000
Spain	1,900,000	284,890	13,308	15,410	10,142	323,750	2,200,000
Japan	2,026,839	365,240	810,464	20,515	145,620	1,341,839	2,191,960
Switzerland	1,285,246	59,606	2,824	25,112	3,289	90,831	1,408,456
Belgium	1,387,654	171,899	60,998	537	948	234,382	1,387,654
Sweden	378,092	73,626	4,875	128	98	78,727	529,772
Portugal	410,000	50,260	1,020	980	15,680	67,940	480,000
Holland	453,752	73,962	8,822	—	2,033	84,817	453,752
Denmark	83,684	24,342	331	—	472	25,145	83,684
Norway	73,568	9,690	894	—	201	10,785	73,568
U. S. America	30,313,000	5,368,000	*not stated*	*not stated*	*not stated*	5,368,000	30,313,000
Canada	778,346	114,665	—	453	300	115,418	855,293
Mexico, Brazil, etc.	597,620	4,607	—	375	242,699	247,681	2,900,000
Total	126,737,132	13,957,330	3,116,763	701,985	2,055,314	19,831,392	140,693,103
Totals.							
31st August, 1911	121,277,197	11,559,401	3,647,714	664,822	1,947,133	17,819,070	137 278,752
31st August, 1910	119,473,025	11,145,178	3,683,912	639,596	1,561,825	17,030,511	133,384,794
31st August, 1909	115,971,004	12,098 280	2,479,315	781,107	1,308,735	16,667,437	131,503,062

COTTON SPINNING SPINDLES, 31st AUGUST, 1912.

As Returned by Spinners.

Countries.	Mule Spindles in Work as per Returns.	Ring Spindles in Work as per Returns.	Spindles Spinning Egyptian Cotton as per Returns.	Spindles Spinning American, East Indian, and Sundry Cottons as per Returns.	Spindles in Course of Construction as per Returns.	Total Number of Spindles as per Returns in Work at Present.	Total World Estimated Number of Spinning Spindles.
Great Britain	39,848,727	8,885,218	13,256,816	35,477,129	461,172	48,733,945	55,317,083
Germany	5,302,120	5,259,962	1,376,070	9,186,012	271,286	10,562,082	10,725,732
Russia	3,247,204	4,522,703	951,296	6,818,611	186,440	7,769,907	8,800,000
France	3,967,536	3,179,274	1,439,632	5,707,178	73,640	7,146,810	7,400,000
India	1,200,015	3,215,573	20,258	4,395,330	192,688	4,415,588	6,195,214
Austria	2,527,267	2,270,668	556,513	4,241,422	126,544	4,797,935	4,797,935
Italy	991,199	2,631,865	198,680	3,424,384	—	3,623,064	4,580,000
Spain	760,000	1,140,000	—	1,900,000	—	1,900,000	2,200,000
Japan	39,845	1,986,994	278,908	1,747 931	103,000	2,026,839	2,191,960
Switzerland	1,052,438	232,808	850,000	435,246	—	1,285,246	1,408,456
Belgium	541,418	846,236	4,300	1,383,354	40,288	1,387,654	1,387,654
Sweden	107,268	270,824	—	378,092	—	378,092	529,772
Portugal	100,000*	310,000*	—	410,000	4,000	410,000	480,000
Holland	195,072	258,680	—	453,752	—	453,752	453,752
Denmark	13,376	70,308	—	83,684	—	83,684	83,684
Norway	36,736	36,832	—	73,568	—	73,568	73,568
U. S. America	5,000,000	25,313,000*	660,000*	29,653,000	*not stated*	30,313,000	30,313,000
Canada	374,565	403,781	12,350	765,996	—	778,346	855,293
Mexico, Brazil, etc.	6,284	591,336	—	597,620	37,172	597,620	2,900,000
Total	65,311,070	61,426,062	19,604,823	107,132,309	1,496,230	126,737,132	140,693,103

* Approximately.

knowledge of working mixed lengths of fibres. Combing helps us a long way on towards this ideal, but never fully reaches it.

All raw cottons contain many short fibres which are below the average of the class used. Single, double, and treble combing represent the highest attainment in rejecting short fibre, although cards and blowing-room machinery do something in this direction.

The best place to blend fibres of different lengths is at the draw-frame, and use self-weighted middle rollers afterwards.

It is the usual custom to buy cotton, to decide its spinning value, and to arrange for cotton mixings, on the results of "hand drawing," or "hand pulling" of samples, along with actual inspection of the cotton.

Cotton values representing many thousands of pounds in money, and large weights of yarn, are daily purchased by such testing and judgment of small samples.

Hand pulling of fibres for length and strength is a very quick and convenient method.

Often this testing is only made to decide the basis length by drawing away short fibres.

Finger testing, along with feel, and inspection by the naked eye, is the method almost universally adopted. Mill and machinery tests are frequently made before making large mixings or purchasing further quantities.

In hand pulling, the short fibres may be removed from the tuft before judging the length, and this agrees with mill working since the machinery at once begins to reject short fibre as waste.

Even small samples contain many fibres below or above the average length, and testing by fingers does not indicate the proportions of such fibres to the proportion of average length fibres. Machinery tests help to decide the proportions of short fibre.

If draft rollers are set for average length fibres, a large proportion of long fibres may cause "spewing," although often the yarn is strengthened. Opening rollers is the readiest remedy for "spewing" which means the delivery of thick short undrafted portions of cotton by drawing rollers.

In U.S.A. Department of Agriculture, certain tests by experts failed to judge average length nearer than $\frac{1}{8}$ inch and fewer still nearer than $\frac{1}{16}$ inch.

Non-expert hand testing of cotton, for purchase or mixings, leads to frequent trouble and loss in spinning mills.

More scientific methods of judging cotton have been advocated and more may yet be done in this direction in our more important spinning mills.

It would be difficult, however, for cotton brokers to send samples of many cotton sorts to all spinning mills for comparatively slow tests before purchases are made.

Where full tests are desired before using actual testing of cotton in the machines may be deemed sufficiently satisfactory to restrict or delay the adoption of more scientific methods. It is not a difficult matter to put samples of moderate size through the ordinary machinery, and it is rather difficult to realise how so-called scientific methods can reach more accurate commercial decisions than actually passing samples through the machinery, although the work may be done more quickly.

Some mills maintain sampling machines.

Microscopical examination of cotton is adopted in a few spinning mills and possibly more could be done in this direction.

Good inside management of spinning mills can usually minimise yarn and mill troubles, due to errors in cotton buying, by altering the cotton mixings on signs of trouble, or by altering draft pinions and twist wheels, and sometimes making temporary speed adjustments.

Sometimes it has been imagined cotton was of longer fibre because it was damp in the pulled sample and consequently was less crinkly in the fibre.

Dry cotton gins more freely than damp cotton and with less damage and better average fibre length. There is probably little or no truth in the contention that cotton may continue to grow after picking.

Mechanical Methods for Sorting and Measuring the Length of Cotton Fibres.

All over the cotton world there are men who have become expert in rapidly testing the length and strength of cotton fibres by pulling between the fingers and thumbs of their two hands. Some men become much better than others.

By this method mill managers will run through a market of twenty to thirty samples in one morning visit to Liverpool, and will back their Liverpool judgment by actual mill results to a considerable degree.

Cotton brokers, cotton graders, mill managers, and carders in the mill, can go a long way by such hand tests, and transactions involving thousands of pounds have very often been done on such testings. Both length and strength of fibre are judged in this manner—the two features constituting what is understood by the term "staple." Especially may a person become exceptionally expert in such tests and in his personal judgment of cottons when his work is practically confined to a limited range or class of cotton.

So universal is this method of judging cotton, so rapidly may the judgment and selection be made on this basis, and so generally

reliable are the mill results when done by competent and careful persons, that it is difficult to imagine that any mechanical method of selection can effectually supersede this "hand-pulling" test.

It is, however, quite possible that mechanical appliances and methods may supplement and help in the sorting, selection, testing and judging of cotton, and may be utilised with advantage, and there is a distinct modern tendency towards this development.

The hand or thumb and finger test may be either done very crudely by insufficiently competent persons, or it may become a highly expert business when done by genuinely competent persons.

For fuller tests it is possible to run a small sample of cotton right through the ordinary mill machines and make some yarn in about a day's time or rather more, even if a mill does not possess a proper set of sampling machines.

In some cases mill managers carry small blackened pocket rules to aid in judging exact length of fibre.

The "sledge tester" of Dr. Lawrence Balls—as first seen by the present author at the formal opening of the Shirley Institute in 1922, but devised some years previously—has attracted the attention of many cotton mill men, and is certainly an interesting method of sorting and judging the cotton fibres in any samples.

In June, 1922, Mr. W. Isherwood, of Manchester, acting in his capacity of agent for Messrs. Henry Baer of Zurich, demonstrated to the present author the construction and operation of yet another appliance designed to aid in sorting and measuring the length of cotton fibres, and which we are told has been successfully used in America for some time.

It may be at once said that the apparatus is simple, very reasonable in cost, capable of operation by a girl or ordinary tester in the mill, and may possibly sometimes prove a substitute for running cotton samples through the mill, or at least as an aid to the older methods of testing cotton.

Take the case of an important spinning concern, in which the general manager desires to know his cottons as fully as possible, without too much of his personal time and attention being taken up in "pulling" and judging.

A careful employee of either sex may easily learn to become extremely quick and accurate in using this appliance. Several hours practice should be enough. The sample being supplied, the operator will quickly make tests, sort out and arrange the fibres in proper order from longest to shortest, and prepare diagrams for the inspection of the chief authority; the diagrams being retained for later comparisons if need be.

Given a satisfactory appliance, used by a careful and competent operator, there is no reason why the work of a general manager

may not be rendered easier, and the business of the concern be conducted more satisfactorily.

Finger tests in the first instance, and making actual samples of yarn as a final and full test, will probably never be entirely superseded, but may certainly be aided by a mechanical measurer of this kind.

The author was impressed by one strong feature in Baer's apparatus, apart from its simplicity, moderate cost, and general suitability. The feature alluded to consists in the fundamental principle of the apparatus being the same as that employed in its first stage by finger tests and in its more advanced stage by the Heilmann cotton comber in separating the long fibre from the short.

There are several sets of fine combs arranged horizontally as bottom combs, and there are also top combs of fine needles, the fibres being drawn between these top and bottom fine needles by special detachers or nippers operated by hand. The apparatus may almost be described as one head of top and bottom comber needles, opened out flat, through which the fibres are drawn in a specific manner by the hand nippers or pliers. The longest fibres are drawn out first and laid on the blackened card, then a set of shorter fibres, then shorter still, until a fully graduated card of fibres is obtained. A measuring glass being placed over the extracted and combed fibres, an excellent view is obtained of proportions of all the lengths of fibre composing the sample.

By the kindness of Mr. Isherwood we illustrate this instrument and its accessories.

In a diagram or test the proportions of long, short, and medium fibres are indicated; the proportion of short fibres which would be floating, and the proportion of fibres which might be pinched or gripped by opposing rollers, when rollers are set for average length.

Provision is made for arranging all the fibres of a sample side by side, in due order from the longest to the shortest, starting always with the longest.

Description.

Fig. 9 illustrates a typical arrangement as pulled by the aid of this appliance.

Fig. 6 indicates a front view of the appliance itself with some of its lower comb bars dropped. The whole apparatus only occupies a space of roughly about a foot long by half a foot wide and half a foot deep. A hand-box will carry it about much the same as a microscope box.

Fig. 7 indicates on the left a small wooden press block or rake for pushing the fibres well into the comb teeth, with a needle to help

in straightening the fibres. On the right of Fig. 7 the tweezers or nippers are shown as used for drawing the fibres out of the combs.

Referring to the front view of the apparatus as given in Fig. 6, and as examined by the present writer, the combs are sustained

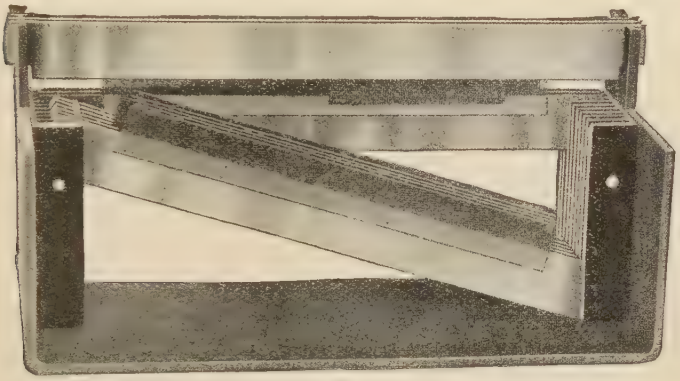

Fig. 6.

in a metal framework formed all in one piece, with a base to rest on any desk or table, and the two ends turned up and suitably slotted, each end containing nine vertical slots. The nine bottom combs are loosely dropped into these nine vertical slots with the combs pointing upwards. Thin metal pegs are used for locking

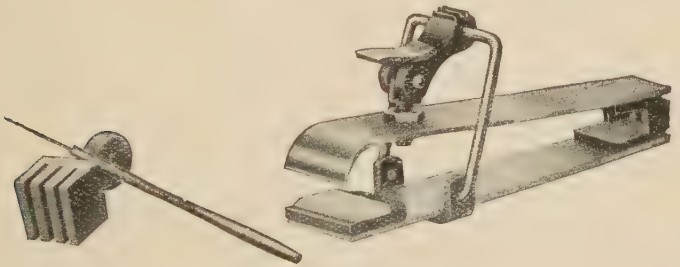

Fig. 7.

the bottom combs in their top position for making a test, or in bottom position when not in use. By taking away one of the pegs when making a test, one comb after another may be lowered at one end, as shown in Fig. 6, so that shorter and still shorter fibres may be gripped and extracted by the nippers. The rows of combs may best be compared to the top combs of any Heilmann

or Nasmith comber. Possibly about sixty combs per inch of length. Each comb is a straight metal bar inset with fine needles. Nine of these make a set, dropped into the slotted framing behind and parallel to each other to make a total needle width exceeding the lengths of cotton fibres.

Each bottom comb has needles over its entire length, but each top comb has needles for only about 3 to 4 inches.

A preliminary pulling of the fibres is first made by drawing the sample through the bottom combs only. For the second or proper test the top combs are placed over the bottom ones with their needles operating together to clean, parallelise, and resist the pinching or pulling draft upon the fibres. Needles of top comb point downwards, and needles of bottom combs point upwards during a test.

Operation of Testing.

Make a small sliver by doubling and drawing several times between fingers and thumbs, and reducing the sliver to about one-third to one-fourth the thickness of an ordinary card or draw-frame sliver, i.e. to about 1's counts, and a full 2 inches in length. Breathe on the sample to make it sufficiently damp, and place straight on the needles of bottom combs only. A point of sliver is left protruding behind the bottom combs for possibly 1 inch and resembling the cut point of a water-colour brush. The comb-box is turned round

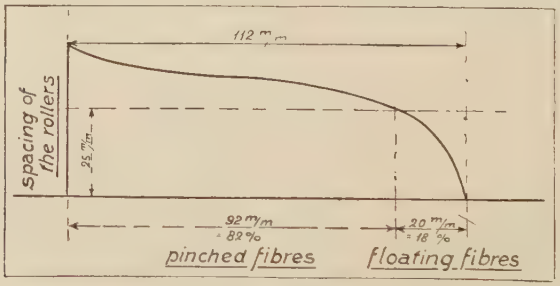

Fig. 8.

back to front. By means of the tweezers the front ends of the fibres are drawn out to clean them, and are straightened by thumb and finger. The extracted bunch of fibres is placed straight across the bottom combs on their other side, the tweezers touching the back comb. It is placed lightly on the needle points and the fibres thrust deeper into the needles by the wood press block or rake. This procedure is repeated until a sufficient bunch of fibres is obtained for making the final and real test, the first and smaller

groups of fibres being superposed exactly in the combs so that their extreme ends overlap the back comb to the same extent. To get the desired accuracy the point of the strip needs to be equalised before each drawing of the fibres, the pincers only acting on the fibre extremities. Sufficient fibres are obtained in this first selection to make a diagram of possibly 6 inches long graduated down from longest to shortest fibres.

The first selection having been made, the top combs are placed over the bottom combs, with the fibres between. The framing is turned round with its front again facing the person making the test. The tweezers are used to pull out first the longest fibres, which are laid carefully on the velvet covered plate, the fibre ends being held to a chalk mark in as exact line as possible. When necessary, the locking peg is drawn back somewhat so as to drop the front bottom comb down at one end, so that the tweezers can extract the next lot of shorter fibres. This is repeated for other combs until the sixth bottom comb has been dropped and then the three top combs are successively taken away.

Finally all the fibres remaining may be placed at the short end of the diagram. Fibre diagrams are obtained similar to those shown in Figs. 8 and 9.

Diagrams could be prepared from cotton as delivered by opener, scutcher, card, or other machine if desired. One use of such a diagram should be to help in deciding the setting distances of draft rollers.

The sample to be tested should be doubled over and into a form much similar to a thin card or draw-frame sliver, and better results are obtained if the cotton sample is made somewhat damp by breathing upon it. Dry fibres resist the making of a good diagram. A sample may be slightly damp, about $2\frac{1}{2}$ inches long, and about one-quarter thickness of an ordinary card sliver or say about 1's counts.

Accessories.

As described above, in addition to the central appliance the accessories are as below :—

1. A patent pair of tweezers or nippers (Fig. 7).
2. An aluminium plate covered with black velvet on which the fibre diagram is prepared (Fig. 9).
3. A graduated glass guage for obtaining the surface outline of the diagram formed by the fibres, and which offers convenience for transferring the fibre diagram to suitable paper. This glass gauged is properly ruled and marked (see Fig. 10).
4. A small wood press block for pressing the fibres into the needles, and termed the "rake" (see Fig. 7).
5. A needle for straightening the extracted fibres. It appeared

to the present writer that the nippers or pliers might readily be made to operate automatically.

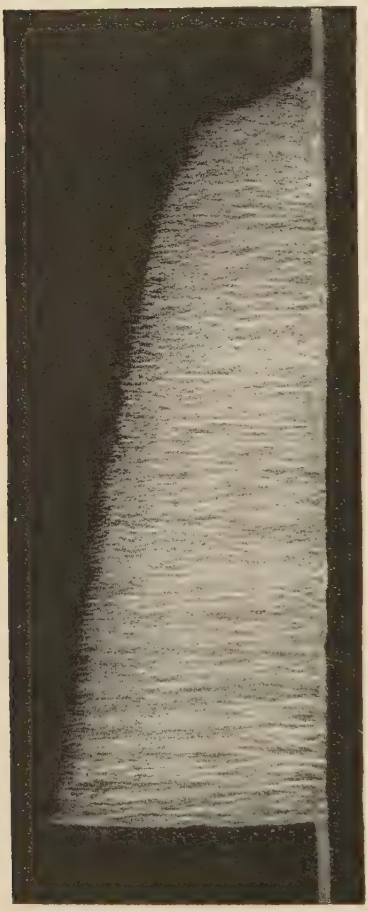

Fig. 9.

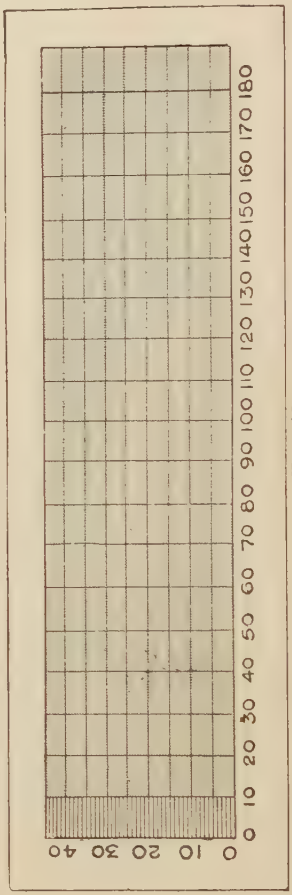

Fig. 10.

Packing and Opening of Cotton Bales.

A Bohemian gentleman, with considerable English training in the cotton trade, wrote as follows to an English journal from Bohemia :—

" Fradulent packing of cotton is no novelty to us, for we continental people with our low rate of money have to take the cotton that is left over, and we have to bear the consequences without getting a farthing damages.

". . . I have done away with the ordinary transport lattices, and instead, am transporting pneumatically the cotton from the hopper bale-opener to air-tight continually ventilated cotton chambers. I leave the mixing of eight to ten bales in these aerated chambers two to eight days, and give the damp cotton a chance to recover. My scutching and carding are easier and more economical. The hopper bale-breaker must be set to take off flocks and not big lumps. Other advantages are no cost of maintaining or lubricating lattice rollers, no dust, air-tight, and fire-proof chambers."

Mill Standardisation.

The machinery and methods of the cotton trade have been dealt with by many of the best brains in the industrial world for many years past, so that standardisation and repetition work goes on to a greater extent than in almost any other great industry.

We have standard twist constants, standard change positions in the machines, lists of drafts, speeds, twists, counts, cottons, wage rates, productions, and work required from one individual, standardised almost beyond any other large business. Card tenters, strippers and grinders, draw-frame tenters, comber tenters, and others have standards in regard to amount of machinery to mind. We have standard lengths of machines, spindles, bobbins, cops, weights and sizes of bundles of yarn.

Arizona Cotton.

In 1900 seeds for long-staple cotton were imported into Arizona from Egypt and the U.S.A. Government aided in experimental cultivation near Phœnix in the Yuma Valley and other places.

In 1911 a Salt River farmer obtained long staple seeds from the Sacaton Indian reservation to plant about 5 acres of the Yuma variety of cotton. Results were sufficiently good to cause other farmers not far away to do likewise, so that in 1918 the crop was given at 34,000 bales, and for 1919 it was estimated at double that number. It is clearly a case of whether it pays the farmers or not to plant cotton. A production of one-half bale per acre was the average.

There are several hundreds of main canals in the Salt Lake Valley, the water supply being vastly helped by the famous Roosevelt Dam.

Cotton Fibre Measurement and Length Testing.

A handy little pocket rule is sometimes used by purchasers of cotton to help in judging cotton by the usual finger and thumb

pulling test. This rule may be of boxwood about 1½ inch wide by about 4 inches in length when closed up. It is made on the slide-rule principle, by having a central sliding piece about ⅜ inch wide and painted a good durable black. The boxwood rule is divided into inches and fractions, or in any other manner, as desired.

The pulled cotton sample may be placed in the long hollow slot, upon the blackened slide piece, which is then moved to bring the end of the cotton tuft to the initial inch or other mark. In this way it may be possible to quickly judge the length of fibre rather more accurately than by depending upon eye judgment alone.

At the carding engine the condensing action of the doffer comb, and between the cylinder and doffer, place the fibres in an indiscriminately crossed condition, in which some of the fibres may become not far removed from parallel to the doffer, although the pulling action of the calendars may at once slightly improve on this position. At the first draw-frame it is difficult to adjust the distances to operate satisfactorily on such fibres, but the use of small initial "carrying" and roller drafts soon tends to place fibres more or less leading towards the direction parallel to the sliver length and at right angles to the roller length.*

Lantern Slide Testing.

In one suggested method of deciding lengths of cotton fibre, lantern slides are prepared from cotton samples, the views are reproduced on the screen, and map-measuring instruments are used to obtain lengths of fibre from the much enlarged views.

There is a small pocket instrument occasionally used when cotton men require an aid to the eye in judging cotton. Many mill managers appear to be worried more about getting cotton delivered fully equal to the sample than about mechanical aids to their judgment.

By the lantern slide method, graphs may be drawn on squared paper representing the number of fibres of each length measured, as well as variations between maximum and minimum lengths.

One cotton may have quite as much variation in extreme lengths as another, but the greater question is, does a cotton contain a larger or smaller proportion of any one length of fibre, such as maximum, medium or basis length, or minimum length?

A curve drawn through the upper ends of the fibres in such a graph ought to show at a glance such points as: proportions of short fibre, of long fibre, fibre of medium length.

If fifty fibres were taken in a sample, every fibre should be put in its position of length in the ascending or descending scale of the

* Dawson's "semi-combing" plates and funnels are designed to help this effect."

graph, and in this way an idea may be obtained of the real average length. A uniform cotton with the bulk of its fibres near one length will usually do better than a cotton having some longer fibres, but showing greater variation. It is possible some such test could be applied to comber waste, card strips, or roving waste. The author prefers some such instrument as Dr. Balls' sledge-sorter, or the more recent Baer's length measurer, if any instrument is desired at all, in addition to, or instead of "hand-pulling," followed by passing samples through mill machines.

MICROSCOPICAL INVESTIGATIONS.

Fibres in Cross Section of Yarn (Sewell of Bolton).

Counts.	Fibres.	
250	21·5	Sea Island cotton
210	20·3	Sea Island and Sakel cotton
175	23·9	Sakel cotton
147	28·2	,,
135	32·7	,,
122	30	Joanovitch cotton
115	35·8	Sakel and Joanovitch cotton
96	36·2	Sakel cotton
83	52·2	,,
80	52·2	,,
70	57·1	,,
60	68	,,
50	75·7	,,
42	90·9	,,
40	100·2	,,

TWISTS AND CONVOLUTIONS IN FIBRES OF 6 X SAK.

Per inch in the fully ripe fibres.	Per inch in shorter and not quite so well developed fibre.
1915 up to 350	Average 260
1916 ,, 320	,, 240
1917 ,, 320	,, 225
1918 ,, 300	,, 225
1919 ,, 300	,, 200
1920 ,, 300	,, 210

The present author has closely examined these slides under the microscope and concluded the results were accurate to a sufficient degree.

On page 365 of Dr. Bowman's 1908 edition of book on "Cotton Fibre," he gives fibres per cross section in yarns from Egyptian cotton as follows:—

40's single mule	161 fibres
50's ,, ,, ...	129 ,,
60's ,, ,, ...	107 ,,

From these investigations Dr. Bowman points out how little of

the possible strength is obtained in cotton yarns. But Mr. Sewell obtains many fewer fibres per cross section.

Moisture Test.

The use of testing ovens for the somewhat quick testing of the moisture from small samples of the bulk has increased during the last few years, but in many cotton spinning mills such apparatus is yet entirely absent, and reliance is placed upon long established methods, in which no apparatus whatever is used. In such cases if it is required to test for moisture, a good quality of cotton is taken—possibly 100 lb. or so—and exposed for several hours in a very warm position, or it may be sometimes simply spread out in a thin layer on one of the ordinary mill floors, the percentage of moisture being determined by weighing before and after exposure. Special ovens heated by gas, steam, or electricity are used to a fairly large extent in one place or another for testing the moisture in cotton or cotton yarn. In a familiar example the oven is heated by gas, the heat from which passes through the narrow chamber which surrounds the real oven inside which the cotton is placed, so that the cotton may not be scorched by actual contact with the directly-heated portions of the oven. A pair of finely-adjusted scales are mounted upon the oven, with the weights outside and the cotton pan inside the oven, so that the material is weighed while actually inside the oven, both before and after exposure to the heat. Only small samples of the cotton or yarn are taken—say 1 to 2 lb.—with exposures as required at a temperature of possibly 212 to 220° F.

Sampling of Bales at Mill.

It is necessary to carefully weigh every bale of cotton at the mill and compare with invoice particulars.

In most cases it will also pay to sample every bale at the mill by hand pulling and general examination.

Every bale is supposed to be sampled at Liverpool and the buying broker is of great service in this respect, but it sometimes happens that defective bales do get forwarded to the mills, these being either shorter or softer in staple, or more dirty in the bale.

These bad bales or "false packs" may be kept back and samples returned to the broker, with an intimation that the bales will be returned or else a reduction in the price claimed. The mark and number of each bale, number of bands and gross weight are entered in the cotton book, and any special features such as very bad tares may be noted.

A convenient method of trucking and disposing of the bales is necessary so that bales of a class are stored together in a manner

easy to get at. It requires effort to take good samples from cotton bales.

In taking samples from bales the mark and number of each bale should be carfully placed to the sample.

In some few mills a long table with a black top is used for the samples, preferably with a good north light so that the manager may readily inspect, classify and compare the samples.

Tares should be carefully checked and entered, as for example :—

25 Bales Dep.

Invoice allowance	510 lb.
Actual weight	593 ,,
Loss .	83 lb.

Claims may be made for tares above ½ lb. per bale excess, so in this case 83 lb. is claimed for at cotton prices.

COTTON BALE BOOK.

1921.		Cat.	Mat.	Nat.		Total.
March 3	Received	80	10	20		110
,, 5	Mixed	30	5	4		39
,, 6	Stock	50	5	16		71
,, 9	Received					
,, 10	Mixed					
,, 11	Stock					
,, 13	Received					
,, 14	Mixed					
,, 15	Stock					

Meade Cotton.

Writing in May, 1921, it may be stated that attention has recently been attracted to the alleged diminution in both quality and quantity of Sea Islands cotton.

The total crop of Sea Islands cotton is stated at 113,000 bales in 1916-17, in 1917-18 78,000 bales, in 1918-19 almost 45,000 bales, and still less in 1919-20. British takings of recent years have diminished and those of America increased.

Meade cotton represents an attempt to more or less rival or take the place of the Sea Islands cotton of Florida, South Carolina, and

Georgia which is reported to have greatly suffered from the ravages of the Boll Weevil.

Meade cotton is stated to be an Upland variety with $1\frac{5}{8}$ inch staple as against $1\frac{3}{4}$ inch average of Sea Islands. Spinning tests of Meade cotton show $3\frac{1}{2}$ per cent. more waste and a somewhat weaker yarn than Sea Islands, but the Meade cotton is easier to cultivate since it becomes ripe sooner, is easier to pick and gin, and yields more seed cotton per acre. West Indian Sea Islands cotton has been received with favour in Lancashire.

America, the Leading Cotton Growing Country.

Favourable natural conditions of soil and climate, kind of cotton mostly grown in America, abundance of excellent land suitable for cotton cultivation, skill and enterprise of the inhabitants, convenience of transit from cotton plantation to seaports, and from seaports to cotton spinning localities, and freedom from frosts, are the chief reasons for America being the leading cotton growing country. In the Southern or cotton growing States, the temperature is mostly sufficiently warm, without being tropical, the amount of rainfall and the natural humidity are sufficiently high and uniform, while the reasonable use of fertilisers makes the soil sufficiently good for producing large quantities of suitable cotton. In most other countries one or other of these conditions is more or less deficient. Most people require goods of decent average quality, and American cotton is just the kind for producing such goods at a reasonable price, and this helps the popularity of American cotton. No other country has the same combination of such best conditions for cotton growing as are above enumerated. Oklahoma and Arizona have been added to the other cotton States in more recent years.

Extended Cotton Growing.

Strong attempts to extend the growing of cotton in the British possessions have been promoted by the British Cotton Growing Association. India is a British possession, and is already the second largest cotton growing country in the world. Stronger efforts in India could be directed to improving the quality of the cotton, so as to make it more nearly equal to American cotton, but variable conditions of soil and climate, and want of skill in the cultivation of the cotton are serious drawbacks. The West Indies may be taken as an example of success in the efforts to promote cotton growing, and one special circumstance leading to this is the fact that cotton growing is not new to these islands. The West Indies can provide a good quantity of the best cotton equal either to Egyptian or Sea Islands. The British Cotton Growing Association helps in different

localities by providing suitable seeds, by sending expert advisers, by establishing ginning factories, and by aiding in establishing better modes of transport for the cotton and markets for the sale of the same. West Africa is another locality where reasonable success has already been attained, and some of the special success must be ascribed to the centralising of such special efforts as above indicated. A number of years of careful, patient and skilful experimenting are necessary before a country new to cotton cultivation can expect to become a really successful and permanent contributor to our cotton supply. Briefly, we may ascribe the variable nature of success already attained to such causes as the following: Variations in natural conditions of soil and climate, in amount of interest exhibited by the inhabitants, in amount of specialised effort centred at any one place, in facilities for transport, and in good or bad fortune in any particular experiments.

Uganda and the Soudan are places in which it is hoped to produce large quantities of cotton in the near future. The war has hindered progress in these localities, but great things are expected from each locality.

Climate and Soil.

The best natural conditions for cotton growing in regard to the soil and climate have been found to be somewhat as follows: A soil of a loamy nature affected by salty and alkaline properties is considered to be one of the best, while heavy clay-like soils are not very suitable. The best cotton is, of course, Sea Islands.

As regards temperature, we might assume something like 70 to 80° F. as a very suitable range. During the growing of the cotton a moist atmosphere, and well-divided and proportioned rainfall are advantageous, but sunshine and fine weather are required for ripening and picking. Absence of frosts is beneficial. The predominance of such natural conditions will give better and more cotton from the same seeds than their paucity.

Freedom from insect pests such as the Boll-Weevil, is highly desirable.

Ideal Cotton Fibres.

A cotton fibre may be described as a long flattened tube apparently twisted very many times in its length. A good idea of how it appears under the microscope may be seen from the illustrations, from which it will be seen that transverse sections of cotton fibres are usually hollow, but are more or less flattened out of the cylindrical shape. Immature and badly developed fibres are more or less wanting in the twisted appearance and the tubular formation.

A good, ripe Sea Islands cotton fibre may be taken as an ideal one, and this will be $1\frac{3}{4}$ to 2 inches in length, about $\frac{1}{1\frac{5}{7}\frac{5}{3}}$ inch diameter, of a tubular formation, very fully and uniformly twisted, and of creamy or silky appearance.

The growth and development of the fibres commence soonest at the apex of the seed, or the position most removed from the point of attachment, and this is the clue to the fact of fibres from same seed being differently developed in regard to thickness of tube walls and natural twist.

Defects in the soil, bad growing, ripening, and picking weather, poor seeds and careless cultivation have much to do with cotton fibres often coming short of attaining the ideal, while the Boll-Weevil may kill the cotton plants.

Hard and Soft Cottons.

Rough Peruvian and smooth Peruvian are most typical examples to illustrate this feature. The former is of a hard, harsh, wiry nature, and would give a loose, oozy, but more or less harsh appearance to cotton yarn. Indeed this cotton is so rough that it is more often mixed with wool fibre in the production of union or so-called woollen goods.

Smooth Peruvian is altogether softer and nicer to the feel, and is more suitable for wefts.

Any typical Brazilian cotton may be added to the rough Peruvian as an example of what might be termed a hard or harsh cotton, such, for instance, as Pernambuco, Paraiba, or Maceo. Ordinary Uplands American is again a typical example of a "soft" cotton, being soft to the touch, short in staple, but usually fairly clean, and only an inch average staple. It is a typical weft cotton. As an example in the better qualities, of a nice soft cotton, we might take some of the Egyptian or even a typical Sea Islands cotton.

Ginning and Packing.

In a general way defective ginning and baling both tend to reduce the value and price of the cotton.

The process of ginning is necessarily a more or less rough one, as the delicate cotton fibres have practically to be torn or plucked off the seeds, and the fibres and seeds adhere to each other somewhat tenaciously.

Speaking generally, there is a tendency to break and lacerate the fibres more or less in almost any form of ginning, and when this is done to an excessive extent, the value and price of the cotton are correspondingly reduced.

As regards baling, it has been ascertained that the great pressure exercised on the fibres in the baling process does very little real harm to the fibre, although it would be all the better if we could do without baling, partly on account of the subsequent opening processes. The defective coverings of American cotton bales have often caused the cotton to get stained and dirtied in transit, as well as increasing the risk by fire. Generally speaking, the American cotton bale is the worst-looking one that reaches our English mills. Defective ginning is more likely to give bad spinning than bad baling is.

Damage by the Saw-gin.

The distinctive feature of the saw-gin is the use of possibly 60 —more or less—finely-cut circular steel saws secured on a suitable shaft. These saws protrude somewhat through the bars of a grid, on the other side of which is the seed cotton. The fibres are torn from the seeds by the saws, and are drawn through the grid, which, however, is too closely set to allow the seeds to follow. It is between the saws and the grid that damage to the fibre mostly occurs. Saws rubbing against the grid, saws out of condition, overfeeding, excessive speeds of saws; are causes of nepping, cutting, breaking, and rolling of the fibre.

Use of Various Cottons.

Boweds, Joanovitch, Uplands, Maranhams, Oomra, brown Egyptian.

The term "Boweds" is occasionally applied to ordinary Uplands cotton of moderate quality, such as grown in the country coming between the mountains and the ocean in the States of Georgia, Carolina, Virginia, and Alabama. It is mostly a weft cotton from 30's to 40's counts, or finer from single roving. Joanovitch preceded Sakelarides, and proved to be one of the best and most favourite of Egyptian cottons, strong and fairly uniform in the fibre, lighter than most Egyptian cottons, and suitable either for carded or combed yarns of good quality from double roving. Often mixed with other cottons. More or less used for any yarn counts ranging usually from 60's up to 140's, the finer ranges being combed and either twist or weft. Maranhams is an excellent and typical Brazilian cotton $1\frac{1}{8}$ to $1\frac{1}{4}$ inch length of fibre, suitable for any counts of yarn from about 40's to 70's, perhaps more often used as a twist cotton. Oomra is an Indian cotton of a better nature than much Indian, about $\frac{7}{8}$ inch length of fibre, and may spin yarns of cheap quality as high as about 24's. Brown Egyptian of one kind or another has constituted the basis of Egyptian cotton, the brown colour being one of the most distinctive features of most

Egyptian cotton. Brown Egyptian varies in quality and in depth of colour, and is used for good yarns of any counts up to 140's or higher the finer counts being combed.

Of recent years the colour of Egyptian cotton has become very generally lighter, and less distinctively brown.

Gin-damaged Cotton.

It is generally agreed that the saw-gin is the chief offender in regard to cutting the fibre, nepping, or stringing it. Untrue setting or operation of the saws may rub the fibres against the bars of the grid, and thus injure the cotton. It is possible for the saws to be so sharp as to cut the fibre, or the saw shaft may be run so quickly as to treat the fibres too severely. If wet or damp cotton is ginned it is more difficult to separate the fibres from the seeds, and this may lead to rupture of the fibres. One indication of gin cut staple is the tendency for cotton to form into small clusters of more or less neppy cotton. The fact that cotton is unnaturally free from leaf or other undesirable matter is sometimes taken as a possible indication of over-ginning. Long staple cotton would be cut and injured excessively by the saw-gin, and the Macarthy is used for such staple, but care must always be exercised to avoid choking or over-feeding of this latter gin, which is much less capable of yielding a heavy production than is the saw-gin.

Occasional Failure of Cotton Crops.

The chief causes of reduced cotton crops may be stated as below: (*a*) Referring to America, reduced acreage planted with cotton due to fear of planters that profitable prices will not be realised, or to rotation of crops; (*b*) late frosts in spring, which kill the young plants at the outset, or early frosts in autumn which will kill the plants before they have yielded their maximum amount of cotton; (*c*) insect pests, which often kill the plants or reduce their yielding capacity; (*d*) scarcity of rain on the one hand, or very bad storms on the other hand. As regards Egypt, failure to skilfully and sensibly distribute the stored up and overflow waters of the Nile, and want of due regard to the rotation of crops, have sometimes been factors in shortness of supply. Cotton cornerers have occasionally created a somewhat artificial shortage for the time being. The total cotton crop of the world in 1914 had become annually much larger than it ever was up to a very few years ago, but there had been recent exceedingly rapid increases in the number of spindles, and therefore in the annual consumption of cotton. Cultivation of raw cotton has scarcely kept pace with the increase in consumption, but there is yet plenty of suitable land available for cotton growing in America and other places.

Cotton Weights, Measures and Values.

On 1st October, 1910, representatives of the master spinners and weavers adopted a resolution as below given, by means of which tons, cwts., and quarters, and vulgar fractions in money, were largely discontinued in the trade. It was resolved "That all spinners, manufacturers, yarn agents, cotton goods merchants, and waste dealers, etc., when quoting, tendering, or contracting for cotton yarns, cotton waste, and cotton goods of all descriptions, to express all fractions of a penny in hundredths, and not in vulgar fractions." "That on and after 1st October, no new contracts be made by members of any branch of the cotton trade in weights of tons, cwts., and quarters, but in place thereof the weights shall be in pounds only, with multiples of 100 lb. and 1,000 lb. where large units are deemed desirable." Apart from this alteration, the principle of the metric system had received little favour in the British cotton trade up to July, 1922.

Deterioration of Egyptian Cottons and Introduction of New Kinds.

One of the distinctive features appertaining to Egyptian cotton is that well-known types in the course of from ten to twenty years deteriorate in quality, and often also in quantity produced. For example, Gallini cotton used to be a familiar and excellent Egyptian cotton, but is now seldom heard of. Several years ago Joanovitch was introduced as a new type of Egyptian, and obtained a great reputation for both quality and quantity. More recently still we have Sakelarides cotton attracting the attention of buyers. Deterioration in value has been attributed to constitutional causes, such as original impurity of seeds and contamination by a natural mixing up of seeds. In regard to quantity, conditions of environment such as skill and care of cultivation and natural exhaustion of soil, have some influence in this respect. As regards future improvement greater care in selection of seed year by year, greater care in the proper distribution of the Nile waters for irrigation purposes, and similar circumstances would probably give good results. It is expected also that an improvement will result from the efforts of the Government to introduce a better system of drainage and to reclaim a considerable amount of land that has gone out of use owing to water-logging. If planters get better prices quantity and quality are likely to improve. Writing in 1922, it may be said that Sakel cotton has for some years dominated the market in Egyptian cotton.

Cotton from West Africa and Uganda.

From West Africa there has been a moderate supply of raw cotton for very many years past, but as a rule it has been of a very

poor quality; little, if any, better than Indian. The British Cotton Growing Association, however, has directed considerable effort towards improving the quantity and quality of cotton from British West Africa, British East Africa, and from the adjacent Uganda. The results of many experiments have shown that cotton of the Egyptian type may be more or less successfully grown from imported seeds in these localities, and with the aid of experts financed by the association a good deal of this kind of cotton has been produced during recent years. The provision of ginning and baling factories, persistent experimenting with different varieties of seeds, the introduction of trained persons to help in training the natives, the provision of better means for transporting the cotton, assistance in marketing the produce, and advice in regard to suitable areas and soils for cotton growing are chiefly responsible for improvement in regard to African cotton from the areas specified. The difficulties have been found greater in British East Africa and in Uganda than in West Africa, because already an appreciable business in raw cotton was established in the latter place before the British Cotton Growing Association was established. Cotton grown in these localities from the seeds of brown Egyptian cotton has been found to retain the brown or deep colour more or less.

Mixing of Unequal Cottons.

Blowing-room.—It is customary to set the beater of the scutcher a little farther away for long fibre than for short, and extreme variations in the staple might result in the long fibre being broken or the short fibres taken forward irregularly and in clusters. It is not very probable that any ordinary variations in the fibre would show up prominently in this way. The air current always tends to take short light fibres forward more readily than long fibres, and in this way the short fibres are laid on the top cage and form a coating for the top of the lap sheet, and in this way lead to lap-licking. The speeds of the beater should be quicker for short cottons than long ones.

Carding.—There will be an excessive amount of waste and much stripping will be necessary owing to the presence of a large amount of short fibre. With the feed-plate it is usual to give a different shape for long than for short fibres, and this cannot be done in the case under discussion. There will be danger of the long and short fibres being nepped. It would be difficult to suit the weight of sliver, and the production of the card to suit both long and short fibres.

Subsequent Processes.—In all the processes subsequent to carding it would be difficult to set the drawing rollers to suit both long and short fibres to the best advantage, although self-weighting of

middle top rollers and setting inside the long fibre length at the mule, will do something in this direction.

Very probably we should get cloudy and irregular slivers, rovings and yarn, due to the short fibres issuing from the rollers in clusters and wrapping round or standing out from the body of longer fibres.

Naturally there would be bad spinning and much waste on the flyers, top clearers, under clearers, etc.

Mixing at draw-frame and using self-weighted middle top rollers at roving frames, mules, and ring frames, represent good practice with mixed lengths of fibres.

Cotton Mixing.

The primary object of cotton mixing is to obtain and maintain uniform conditions in regard to spinning, amount of waste, and general quality of the finally spun yarn. Even if only one so-called class of yarn be used it is well known that the cotton varies appreciably in one respect or another due to natural causes which apply more or less to the fruit of plants of almost any description. It does not pay to have cotton going through the mill above the average quality one day, and then a few days afterwards to be below the average for the same yarns. Mixing of cotton reduces the danger of such variation, and large stack mixings are admittedly the best for maintaining absolute uniformity day after day. If one mixing only lasts two days while another lasts a fortnight, and has been properly made to begin with, it is obvious that the latter is best for uniformity. The mixing should stand a few days before using, and this helps the cotton to attain a natural working condition of dryness, besides permitting the cotton fibres to naturally tend to loosen themselves from one another.

It frequently happens that a cotton spinning mill is not provided with a sufficient quantity of just the kind and price of cotton required, if all one kind is to be used. It may be very difficult to meet exact requirements if only one kind were suitable. The available quantity of one exact kind of cotton on the market may be limited. Primarily, cotton mixing enables a spinning firm to maintain something like uniform working conditions, and to continuously produce yarn which seldom varies very much from the required standard. Mixing enables the management to use a limited quantity of better class cotton so as to prevent the working conditions and resultant yarn from coming much below requirements. On the other hand it often permits the introduction of a quantity of low-priced cotton so as to cheapen production, without upsetting the business with bad work, excessive waste, and unsaleable yarn. For the better qualities of 50's warp yarn we may use Egyptian

cotton or Brazilian cotton, or some of the best Americans, with double roving at the spinning machine. For medium qualities of 50's some of the Brazilian cottons, or good Orleans, or other decent quality of American. For cheap qualities of 50's yarn we might produce the yarn from single roving from some of the better sorts of ordinary American cotton.

Mixing enables us to blend together cotton bales of different marks, and somewhat different values, in order to obtain the special effect suited to the yarn that is being spun, and the prices obtainable.

A great deal of cotton is spun on comparatively small farms or plantations, and it is quite possible for bales of the same mark to differ somewhat in spinning qualities, since different small lots of cotton, especially in America, may be, and have been, collected, graded, classified, and marked together.

One of the greatest desideratums in cotton spinning is to secure uniformity in working and spinning the cotton, and in the finished yarn, and hence the extreme value of cotton mixing in one form or another, even with bales of the same mark and delivery.

Mixing at the Bale-breaker.

Mixing at the hopper bale-breaker is not necessarily a rival to stack mixing of cotton. In a modern mill the mixing will very likely be done at the bale-breaker, whether a stack mixing is made or not. Suppose a stack is to be made, then bales of the various sorts of cotton to be used will be placed conveniently to the feed-part of the machine, and portions from each bale in succession will be passed through the breaker, and deposited by the mixing lattices in the proper mixing bins. Assuming stack mixing to be done without a bale-breaker, as it still is in small mills using only a small weight of cotton per week, then layers of cotton from the various bales in succession are pulled and distributed by hand upon the mixing. It is not at all likely the pulling will be done as effectively by hand as by machine, and the bale-breaker also has the advantage of slightly cleaning the cotton.

In many cases, however, cotton is mixed as above described at the bale-breaker, and is then taken automatically right through the hopper-feeder, all parts of the opener, and made into a lap without making a stack mixing at all. This is the cheaper method, but is not always as conducive to good, regular yarn as stack mixing, since it does not give the cotton an equal chance to dry and open out of itself.

Cottons to Spin a Medium Quality of the following Yarns: 16's *to* 24's, 32's *to* 36's, 40's, 60's, 80's, *all Twist or Warp Yarns.*

To some extent the selection of the cotton would be ruled by the kind of cloth to be manufactured, and whether lightly or heavily sized. The following might be given as suitable cottons:—

16's to 24's might take Dhollera, Dharwhar Indian, mixed with American, or best Indian cottons, although large quantities of such numbers are spun from American cotton, and the Indian that reaches England often has difficulty to spin any such counts. American is best for such counts.

32's to 36's.—By far the greater proportion of such yarns are spun from American cotton, such as Texas, or a moderate quality of Orleans. In a limited number of cases some Indian cotton is used for these numbers. Uplands and Mobile are rather weak for warp yarns.

40's.—Orleans and Texas cottons are most used for 40's warp yarn of medium quality. Oklahoma, Californian, and Memphis may also serve.

60's.—For warp yarns 60's counts medium quality we might take carded Egyptian, South American cotton, or special American cottons, such as Bender's and Peeler's Orleans.

80's.—Carded Egyptian cotton would be the most suitable for making 80's warp yarn of medium quality.

Combed Egyptian is often used for 80's of good quality.

Cottons Suitable for 40's *to* 50's *Warp and Weft.*

For a strong, wiry, twist yarn of 40's to 50's almost any of the Brazilian cottons, such as Pernams, Maranhams, and Ceara, would do very well; while for a moderately soft weft of the same counts Orleans would do. For high qualities of these counts brown Egyptian cotton is often used. Best Texas might do.

The qualities that would determine the selection would be length, strength, uniformity and cleanliness of fibre, and we should determine these qualities by pulling tufts of the fibres between the finger and thumb of each hand, by feeling at the cotton and by shaking it. These qualities and the price of the cotton should be ruled largely by the price we expect to sell the yarn at, being not so high as to prevent the likelihood of profit, nor so low as to give such bad spinning and poor yarn as to drive away the customers.

Cotton Selection.

The leading principle in buying the cotton would be to see that it was suitable for the counts and description of yarn it was intended to spin from it. There is always a temptation to buy cheap

cotton because, say, one-eighth of a penny per pound of cotton makes a large difference in the profits of a spinning concern if the price of the yarn can be kept up. If, however, the cotton costs one-eighth of a penny less and the yarn is so much worse, that, say, one-eighth of a penny per pound less is got for the yarn, while in addition there is a greatly increased percentage of waste and much trouble with the operatives and lessened production, there can scarcely be much true economy in buying the cheaper cotton.

The British Cotton Industry Research Association.

The Shirley Institute at Didsbury, Manchester, was formally opened on 28th March, 1922, and the author was one of a numerous company then having the privilege of inspecting the laboratories, work rooms, and other sections of this notable institute.

On 27th July, 1916, largely through the efforts of Mr. H. P. Greg, a meeting of cotton trade representatives was held in Manchester Town Hall.

At a later meeting—August, 1916—a committee was formed representing the Department of Scientific and Industrial Research and Employer's Associations, representing spinning, weaving, bleaching, dyeing, and printing. Mr. A. Abbott was appointed secretary *pro tem.* After two years of organisation work the above association was established.

The chemist, the colloidal chemist, the physicist, the botanist, the technologist, and the engineer are established in one institute under the guidance and co-operation of Dr. Crossley as Director of Research.

The "Towers" at Didsbury and its estate of 14½ acres, were acquired on 1st May, 1920, and are situated about half an hour's journey from the centre of Manchester. Then belonging to Mr. Daniel Adamson, it was at the "Towers" on 27th June, 1882, that a few prominent Manchester citizens decided to proceed with the scheme for building the Manchester Ship Canal. The laboratories, all specially built, represent the last word in design and equipment for research connected with cotton in any stage. The formal opening by H.R.H. the Duke of York, was preceded by a notable address by Mr. Kenneth Lee. The cotton fibre and its possibilities will doubtless receive every attention at this Institute.

British Empire Cotton Growing.

The cotton trade slump of the first half of 1921 led some people to wonder if any need existed for further developments in cotton growing, since a great surplus of raw cotton existed at the time.

From a maximum crop of 16,000,000 bales, America had dropped to half that amount for 1920-21.

Probably a resumption of normal trade conditions may again lead to increased demand for cotton grown within the limits of the British Empire. Pre-war there was an increasing shortage of raw cotton.

Great Britain possesses an enormous tropical empire in which large areas are suitable for growing cotton, and its cultivation in these places should improve the living conditions of the inhabitants and help to make them potential purchasers of cotton cloth.

About 1895 the cotton crop of U.S.A. averaged possibly 8,500,000 bales of 500 lb. each, of which about 2,500,000 bales were used in that country.

While the total annual cotton crop of America has distinctly increased, their home consumption has become more like 60 per cent. of the total. At times of raw cotton shortage such facts as these are apt to cause food for reflection to English cotton mill people.

After India, *Nigeria* contains the largest tropical population under British rule, possibly 17,000,000. The Nigerian Northern Provinces are well suitable for cotton growing. Seed is given to cultivators, the cotton is ginned, baled, and shipped by the British Cotton Growing Association. A good price is paid for the seed cotton, and for some years a fixed price has been given for the raw cotton. Development in roads and railways help to promote successful cotton cultivation.

Uganda.—With a total area of about 110,000 square miles, adjacent to British East Africa, and a population of about 3,000,000, Uganda has become one of the most important centres of enterprise for cotton growing under the auspices of the British Cotton Growing Association. For the season of 1920 it was estimated to reach 52,000 bales, with a fibre length of about $1\frac{3}{16}$ inch.

Transit facilities, expert agricultural advice and help, expert selection of or provision of seeds for planting, a guaranteed market for the lint cotton, central and efficient ginning and baling plants; these represent important aids to the continued and successful production of raw cotton.

India.—This country has long ranked as second only to America in quantity of cotton grown. Even so, its annual production of possibly 5,000,000 of bales is not great for a country 1,800,000 square miles area and a population of 315,000,000. Indian cotton as a whole is noted for being of low quality, being the shortest and coarsest in staple or fibre and the least clean of any cotton that is grown and used to a very large extent. Except in spinning preparation yarns, or in waste spinning mills, these cottons are not much wanted in England.

In the Canal colonies of the Punjab and Scinde, the Broach district of Bombay, and the Tinnevelly district of Madras, it is possible to grow cotton of an inch or more in fibre length, but much Indian cotton only averages ½ inch to ¾ inch in fibre length.

The Sudan.—Associated with the names of Egypt and the Nile river, attention has been strongly directed to the Sudan for extended cotton production, especially of the ever increasing demand for Egyptian cotton in Lancashire.

The Gezira is a large plain situated between the two Niles, a little south of Khartoum, and this is considered a promising field for extended cotton growing. At an early date it is hoped to have about 300,000 acres of good cotton land available here, aided by the construction of an important dam at Sennar on the Blue Nile. The full scheme here aims at providing 2,000,000 acres of excellent cotton land at this position. Started by Lord Kitchener, carried forward by the Sudan Plantations Syndicate, aid is given by the British Government.

A ginning plant has been erected near Bagdad with a view to encouraging cotton cultivation in Mesopotamia. Experiments have shown the feasibility of growing good cotton in this country, but improved irrigation and drainage facilities are needed, as well as better means of transit.

In some of the West Indian Islands a limited amount of high quality Sea Islands cotton is grown, and much help has been rendered by the Imperial Agricultural Department and the British Empire Cotton Growing Association.

The smallness of the Islands, the successful production of sugar, limes, tobacco, and other articles, operate against extended cotton growing in the West Indies.

To sum up, it has been affirmed that Nigeria, the Sudan, and Uganda offer the best fields for extended cotton growing between lines of latitude 15° north and 5° south of the Equator.

Cotton Growing in Queensland.

Cotton growing is an occupation which has long been held to have very great prospects in Queensland. In 1920 the Queensland Minister of Agriculture said : " The history of the values received by farmers for cotton on the farm show a consistent upward tendency during the last few years, and it is evident that the crop, if profitable at values obtainable in May, 1914, is more so now. In 1914 the farmers received 1·65d. for cotton on the farm ; in 1915 they obtained 2·54d. ; in 1917 the sum of 3·58d. was paid ; and last year 4d. a lb. The tenders in hand for the crop that is now being ginned indicate that the amount payable to farmers will be very close to 5d. per lb. for cotton on the farm ; and upon

1,000 lb. of seed cotton to the acre, which should be realised upon a properly cultivated farm, the return, if 5d. is the amount to be paid, will be £21 6s. 8d. Should it be a fraction less than 5d., the difference will not be great. I strongly advocate the planting of this crop, particularly in view of the dry seasons we are now experiencing and the fact that Queensland should be able to supply the needs of Australia, and, that accomplished, to export to Europe, as it does with butter and cheese. The Department of Agriculture will supply seed to anyone who wants it. Under ordinary circumstances as to rainfall and a proper preparation of suitable soil, the grower may reasonably expect to raise 1,000 lb. of seed cotton per acre, and during the season 1907 there are authenticated records of yields up to 2,000 lb. per acre, the price then ruling being 1½d. per lb., as against the present price of 4d. per lb."

Indian.—A recent agricultural report is quoted as follows :—

"It is of little use if the Agricultural Department evolves pure or improved strains of cotton, increases the outturn by improved practices, and ensures cleaner methods of picking, or if the Irrigation Department provides facilities for the extension of the cultivation of cotton, unless the cotton produced is marketed in a condition which enables it to secure the proper price, and unless the cotton trade pays that price for it." Tabulated results of investigation above quoted are given below.

With satisfactory conditions, and up to a length of $1\frac{1}{16}$ inch it was concluded that Madras might furnish 500,000 bales annually, and the Punjab 200,000 bales, and these cottons would be capable of spinning up to 34's twist and 44's weft.

It was stated that : "The Northerns and Karunganni cottons of Madras, the Broach and Kumpta cottons of Bombay, and the 'Garonoi' cotton of Hyderabad are of excellent colour, strong and regular in staple, with a fibre length from $\frac{3}{4}$ inch to 1 inch. When picked, ginned, and baled in a clean condition such cottons are suitable for hosiery."

There is no doubt whatever that India can produce a great deal more cotton.

It is a moot question whether this will prove much better for England because the English tendency has been for some years to go in more and more for finer and better yarns for which Indian cotton is not suitable. Contemporaneously, the mills of India, Japan, Austria, and Germany have used Indian cotton very extensively. Perhaps indirectly, the addition of more cotton from India, to the total world's production, would leave more of the better cottons for Lancashire.

Reductions in shipping and railway rates, and the growing of better Indian qualities might help in the future.

"Trade Name of Cotton.	Area.	Estimated Quantity Falling in Specified Class.
Class I. (Lancashire).		
Tinnevellies (Karunganni)	220,000	50,000
Bourbon	10,000	2,000
Cambodia (irrigated)	188,000	100,000
Punjab American	276,000	100,000
Cawnpore American	2,000	500
Buri	2,000	500
Broach Navsari	Separate figures not available	
Broach Surat	" "	"
* Bani	840,000	168,000
* Northerns	439,000	65,000
* Kumptar	1,200,000	240,000
Total	3,177,000	726,000
Class II. (Bombay).		
Cambodia (unirrigated)	283,000	100,000
Tinnevellies	320,000	84,000
Westerns	1,150,000	150,000
Saw-ginned Dharwar	250,000	55,000
Wagad	Separate figures not available.	
Salems—Uppam	154,000	25,000
Nadam	10,000	2,000
† Malwa	112,000	22,000
‡ Coconadas	261,000	40,000
‡ Wa-gyi	Separate figures not available	
Total	2,540,000	478,000
Total—Class I. and II.	5,717,000	1,204,000

* If marketed pure; as at present marketed they fall under Class II.
† Only if marketed pure.
‡ These only fall into this Class if a regular staple can be evolved.
N.B.—Lancashire long staple is the commercial inch, actually rather over $\frac{7}{8}$ of an inch.
Bombay long staple, any cotton with an actual measurement of $\frac{3}{4}$ of an inch or over."

Speaking from the point of view of a mill man, one is tempted to ask whether something could not be done in Lancashire towards the greater utilisation of Indian cotton.

Nearly all of our ordinary spinning mills now have revolving flat cards; but it is the author's experience that roller and clearer cards are best for many Indian cottons.

Could the double carding principle, or even the combing principle be better adapted to Indian cottons so as to produce finer and better yarns from inferior cotton?

The United States of America can always produce more cotton

if they are assured it will pay them, although their own consumption has tremendously increased. However, even in America, better results could be got from such features as the following: More successful efforts against the Boll-Weevil, greater care and skill in seed selection and general cultivation, better baling, improved transit facilities, better grading.

Indian Cotton.

In an early issue of the "Manchester Guardian Commercial," an eminent authority, wrote as follows:—

"1. The acreage in India averages about two-thirds of that in America, but the crop is only about one-third, because the yield per acre in India averages only about 80 lb. per acre, as against rather more than double that amount in America, and four to five times as much in Egypt.

"2. As regards quality, the bulk of Indian cotton stands practically at the bottom of the list. There is no doubt that in both these respects the position of the Indian cotton crop could be greatly improved."

Allen Seed Cotton.

An American authority writes as follows:—

"The pioneer in the development of superior sorts of Upland long staple cotton was the late J. B. Allen, originator of the Allen long staple variety. Mr. Allen started with a stock of cotton which he originally obtained from Louisiana having a staple of about 1¼ inch. By selection he produced, about 1880, the well-known Allen cotton, which frequently pulled 1½ inch or better. This variety was the foundation stock of practically all of the 'Extra-Staple' cottons which were grown extensively throughout the section bordering the Mississippi river until a few years ago, when a combination of Boll-Weevil depredation and economic conditions caused the abandonment of this class of cotton.

"The cultivation of long staple Uplands cotton in the South-Eastern States, particularly South Carolina, is based on varieties developed in that territory by scientific methods of selection.

"The first of these cottons was Columbia, originated about 1902 by Dr. Webber. Similar efforts have greatly helped the development of long staple cotton in the South-Eastern States.

"Short staple Upland cotton, however, constitutes more than 90 per cent. of the total Upland product and no particular difficulty is experienced in its production.

"The question of improving long staple Uplands is a much more difficult one."

An American View of Raw Cotton Production.

A well-known American authority made the statement below about May, 1920.

"East India cannot increase its cotton acreage without reducing its cereal acreage, imperilling its food supply and subjecting its dense population to the possibility of starvation.

"Egypt cannot increase its cotton production without extending its irrigated area, which is extremely difficult and expensive.

"The United States is not likely to increase its cotton production much until some way has been found to combat the Boll-Weevil, and check the city-ward tendency of its agricultural population. Arsenate of lime may poison the Boll-Weevil and economic conditions may force population back to the farms, but that is for the future to say.

"These are the only countries in which it seems to be practicable to grow cotton in quantity, although there are many others in which its cultivation is theoretically possible."

The above quotation is made without comment other than pointing out that some British authorities have other opinions.

Chinese Cotton.

Cotton is grown in Shantung, Honan, and other places in China, but mostly in a very haphazard manner. Irrigation, seed selection, use of fertilisers, suitable soils, planting, picking, and ginning, have not been very scientifically or practically dealt with.

It has been estimated that enough cotton can readily be produced to provide China with a very large quantity of the goods they themselves require. American experts have experimented a good deal in China with American seeds and have met with considerable success.

A good deal of American machinery has found its way into China, especially due to the war and subsequent conditions; but most English cotton textile firms have machinery in China.

Dobson & Barlow, Platt Bros., Asa Lees', Tweedale & Smalley, Howard & Bullough, Hetheringtons, Brooks & Doxey; all have machinery in China.

Also from America, The Whitin Co., Saco-Lowell Co., and Lowell Co.

Some years ago the present author was surprised to receive a sample of Chinese cotton from a firm in China, along with a statement that unsatisfactory conditions were being obtained from ginning this cotton with a certain type of roller gin and asking for information on this point. The author sent word back recommending the saw-gin and this proved very suitable. Shanghai, and

its neighbourhood, has long been a great centre for spinning and weaving cotton in China. Many varieties of Chinese cotton come to Shanghai, but it has been stated that Tungchow cotton is of extra quality. Tungchow district is stated to be about 100 miles from Shanghai, and has nearly all its land under cotton cultivation. The cotton is clean and much in demand, and consequently fetches a fair price.

Mechanical Cotton Pickers.

About 1902 Mr. J. T. Broadbent, a former student of the present writer, who had become a teacher in a newly-established southern textile school, sent a miniature bale of cotton to the writer, showing what could be done with a mechanical picker, whose work Mr. Broadbent had examined and tested.

This reference is simply made to show that mechanical cotton pickers have long and seriously engaged the attention of ingenious individuals in the Southern States of America. The well-known cotton expert, Mr. Theodore Price, demonstrated a mechanical picker before the Great New Orleans World's Cotton Conference in 1919.

Different automatic pickers have been on the market arranged for working on the pneumatic principle, or drawing the cotton boll from the tree, by suction. The 1920 picker of Mr. Slukenborg has been tested by him on a cotton plantation at Selma, Alabama: "The mechanism consists of a picker head which is directed by hand to the cotton boll. In this head are two cylindrical brushes revolving inwardly, and a take-off device which combs the cotton from the brushes as they gather it from the plant. Attached to the picker-head is a flexible tube, through which the cotton is conveyed by suction, and the cotton then passes into a cleaning device, from which it falls into a suitable receptacle." The mechanism in the picker-head is operated by means of a flexible shaft from a small portable specially arranged engine. The arrangement can be connected to any type of power tractor.

It is *claimed* for this device that one man can do the work of five hand-pickers, that it does the work better than hand-picking, that it does not injure the fibre, neither is the fibre "twisted, matted, squeezed, or rolled up like snowballs." Scarcity and dearness of labour always fosters automatic machinery.

Progress in the Cotton Trade.

It has often been stated that of recent years that we are on the eve of important discoveries in the cotton trade, that older methods are becoming and likely to become rapidly obsolete, that we must all be on the look-out for progress and invention.

All this is contrary to the writer's observation and practical experience—some of the latter very personal, very disappointing, and very expensive.

There is perhaps no large business more likely to prove disappointing to the inventor. The writer has been consulted on numerous occasions regarding inventions, and has taken note of many others.

Only those who have tried to mend matters in bulk or in detail know how hard it may prove.

Let those who talk and write so profusely about progress in cotton processes themselves try to draft, twist, make fibres parallel, run machines more quickly, get more production and yet maintain good work, use cheaper cotton, make stronger yarns, use the natural properties of cotton fibres to greater advantage, or attain other ideals. It will then be found how easy it is for some people to talk and how hard it is for the same people to do better.

Cotton spinning and cotton weaving are not now so capable, as for example, motor traction, flying machines, and electrical connections, for showing great or rapid development. Such were the times of Arkwright, Crompton, Hargreaves, Cartwright, Kay, and Roberts. Large drafting machines, such as the Casablanca, progress very slowly indeed.

All the more honour therefore to the inventors of the Northrop loom, the Nasmith comber, the Hopper feeder for openers, and just a few more only of modern successes.

The Boll-Weevil.

For about three decades the Mexican Boll-Weevil has increasingly spread destruction over the cotton-growing plantations of the U.S.A. It is estimated that scarcely a quarter of the cotton-growing area is free from the ravages of the boll-worm, and it is thought by some that it will spread to the northernmost limits of cotton areas.

Immense losses have accrued to planters and others from this pest which is stated to be the greatest enemy of the cotton plant. About 30 lb. per acre of ginned cotton has been stated the average loss from this source over a period of ten years, the reduction being from a production of 158 or 160 lb. per acre in 1911 picking.

The cotton plant has the distinctive feature of putting on more fruit than it can fully develop and ripen irrespective of insect or other pests, and this reduces the final production loss.

The Boll-Weevil attains a length of about $\frac{1}{4}$ inch and a diameter of about $\frac{3}{32}$ inch.

Cotton plants appear to be the only or chief plant food of Boll-Weevils. Well on in August these insects tend to fly outwards to-

wards new areas. Eggs may hatch in seventy to eighty hours, and the life of Boll-Weevils may average about two months but sometimes four or five months, and it is computed that one pair may breed millions of other weevils

Heat, drought, other parasites, and birds are natural enemies of the Boll-Weevil. Agriculturists have tried many devices, and it has been suggested that certain areas should entirely omit cotton growing for at least one season so as to starve the weevils out of existence.

Strength of Cotton Fibres.

One authority wrote in 1920 as follows:—

"One wishes to know if the cellulose of the cotton fibre is uniform in resistance to a tensile strain? Does the cellulose of the fibre vary in structure in different cottons, and give rise to variations in strength? Does the strength of different fibres vary according to the cross-section of the cell walls? What factor is it that gave rise to the accepted statement that only a portion of the strength of the fibres goes to the strength of the yarn? Where are the detailed results of these tests to be found, on which this statement is based, that can be used intelligently by the industry, or imparted as useful information for students?"

The present author may add that the Cotton Research Association at the Shirley Institute will doubtless deal with such matters as above indicated in due course.

Baling of American Cotton.

Ordinary American cotton may be formed at the gin house into what may be termed plantation bales, formed in a gin house box 54 inches long × half that width, and having a density of about 13 lb. after it is tied out of the press, being then wider and longer than the box in which it was first formed.

Such a bale may be taken if desired and put on the platen of a standard high density press, with the doors brought up against the sides of the same so as to make the bale, possibly about 21 inches wide × 60 inches high before further compressing to the high density aimed at in some cases.

The uniform size of baling box has greatly extended in use, and it has been recently stated that not 1 per cent. of Texas and Oklahoma bales are made without these uniform boxes and not 5 per cent. anywhere. Much over-sized cotton bales from America are now very seldom seen—not near so much as formerly.

CHAPTER II.

COTTON TRANSACTIONS AND MARKETING.

Liverpool Exchange.

PRACTICALLY since cotton spinning was established as a great industry well over 100 years ago, Liverpool has been the chief market and chief importing and distributing centre for raw cotton of all varieties, although, at first, for a brief period, London was the first market.

In the season 1808-9 there were only 168,000 bales imported, compared with, in 1914-15, nearly 5,000,000 of bales.

Liverpool is well situated geographically for importing cotton from various parts of the world and distributing cotton to the English cotton spinning centres, although Manchester itself gains as a direct cotton receiving port and for distribution to the mills, either by railway or heavy motor transport.

The Liverpool spot cotton market has been long established as the largest in the world.

The Liverpool Cotton Association and the modern, gigantic Cotton Exchange offer great trading facilities on reliable business methods to importers, shippers, brokers, and spinners.

Spot cotton may be bought in Liverpool to-day and be delivered at Lancashire mills to-morrow. Transactions by telephone between any Lancashire cotton mills and Liverpool may be done in a few minutes.

Liverpool is a collecting, dealing, and distributing centre for all kinds of raw cotton and any spinning centres of the world.

At times may be found here cotton from America, Brazil, Egypt, India, Peru, West Indies, China, West Africa, Uganda.

In July and August, Liverpool cotton merchants and importers send out agents to America to buy the kinds of cotton required.

The Liverpool Cotton Association is extremely powerful. A spinner may sell yarn on any one day, immediately cover himself with that amount of raw cotton so as to avoid risk and depend only on legitimate profit. Then in a dropping market some yarn customers reject the yarn or cancel the order. But the Cotton Association finds a way of making the spinner take the cotton in any case.

The objects of the Liverpool Cotton Association are somewhat as follows: (*a*) To make rules and frame contracts for the reliable control of trade in raw cotton. (*b*) To select and store for reference reliable type samples and standards of cotton. (*c*) To facilitate the importation of raw cotton and its distribution to spinning centres. (*d*) The members may be cotton importers, selling brokers who may act for importers or merchants, buying brokers who may agent for spinners, or the representatives of cotton spinning firms. (*e*) A strong connection has now been established between Manchester and Liverpool, and a broker may attend to business in Liverpool in the morning and then be present on Manchester Exchange in the afternoon to fix "call" cotton or promptly meet yarn sales in other ways. Manchester business in raw cotton is increasing. (*f*) The Cotton Exchange regularly procures and gives out important information regarding the raw cotton position.

Big business in cotton "futures" is done at Liverpool Exchange. Formerly such business was done on the "Flags," but later was transferred to the "Room," which served for many years, but then became too small and gave way to the present magnificent Cotton Exchange which was opened in 1906. As in the new Manchester Exchange, the one at Liverpool provides numerous offices and sale rooms for the accommodation of merchants and brokers. Situated in Old Hall Street, not far from the Docks, the number of members is given at about 600, which appears small with the almost 12,000 of Manchester Exchange.

To show the importance of Liverpool as a "spot" cotton market, the following actual stocks of cotton were given for November of one year:—

Liverpool	514,000 bales
New Orleans	134,000 ,,
New York	119,000 ,,
Bremen	129,000 ,,
Havre	95,000 ,,
Bombay	80,000 ,,

Manchester stocks tend to increase in amount due to efforts of spinners and the Manchester Cotton Association. The great war and post-war conditions have much affected such proportions as above quoted.

1st September in any year being taken as the official beginning of the season for American cotton, the stocks may be then low. A month or more before 1st September, Liverpool merchants and importers may send representatives to America, who shall ascertain the crop prospects nearer the spot, and are empowered to purchase quantities and qualities as per instructions, tempered with judgment.

Some of the American cotton dealing firms maintain offices and representatives in important cotton towns, such as Houston.

All cotton reaching Liverpool becomes subject to the laws and bye-laws of the Liverpool Cotton Association, which may not supersede in any case the laws of the land, but which are nearly always strongly enforced in actual business.

Liverpool is by far the world's greatest cotton market in spite of the ever-increasing consumption of cotton in America and other countries. The stock of American cotton in Liverpool is nearly always greater than for any other market. Also, there may be good stocks of East Indian, West Indian, Brazilian, Peruvian, Egyptian, and African cotton. The large stocks of "spot" cotton help to make the Liverpool "futures" market steady and reliable. The sun and business hours, vast storage and loading facilities, position between East and West, and having the Lancashire, the continental, and the world's demand largely based on Liverpool, help to maintain the supremacy of Liverpool.

Sellers of cotton in Liverpool usually predominate over buyers, although this is affected by the laws of supply and demand. A cotton spinner reaching Liverpool states his requirements, and cotton sellers send to his broker's sample room, samples of the exact quality required or purporting to be such. The spinner buyer has the choice of selection from "selected samples," and proceeds to bid until he gets the cotton he wants. The cotton may be sent the very same day or at the spinner's convenience. For export cotton the Liverpool port offers every facility. Cotton may almost always be sold at a price in Liverpool. Often the spinner sends word to his Liverpool broker a day or a few hours ahead of proposed visit.

Cotton Importing.

Towards the end of July and beginning of August most of the cotton merchants and importers in Liverpool send out representatives to the U.S.A. empowered to buy certain styles and quantities of cotton. In some cases Liverpool importers deal directly with American buying firms having centres in the large interior cotton towns.

When the cotton reaches Liverpool it is subject to the laws and bye-laws of the association, which are numerous and definite.

"Reserved" and working standard samples of cotton are kept securely at the Association Rooms and are referred to in cases of arbitration, the standard samples being renewed annually under charge of the seven members of the Appeals Committee.

Daily sales of "spot" cotton are officially obtained or estimated in Liverpool every morning and posted at 11 o'clock in the "Room." At 2.30 p.m. a statement is prepared of total spot sales for spinning mills, speculation, and export, and soon after these returns are made known.

Prices of "spot" cotton may be fixed daily at 12.15 p.m.

Claims for cotton below quality, paying of differences on "futures" cotton, and various matters relating to cotton transactions, are done through the Liverpool Clearing House, controlled by the Cotton Broker's Association.

The term "docket" cotton is applied to cotton tendered and is subject to the ruling of a special committee somewhat more stringently selected than for "spot" or C.I.F. cotton.

"Working" standards of the various grades of the various growths of cotton are kept for reference in any arbitration cases. "Reserved" duplicate standards are also kept for less frequent reference.

Merchants and importers who buy cotton C.I.F. in such markets as Houston for example, and wish to sell same at Liverpool as "spot" cotton, will naturally allow for all costs, freightage and insurance at current rates for same.

A spinners' broker will supply him with any cotton market information as required, such as daily opening and closing prices, and sales, as well as state of market generally. Morning and evening editions of some newspapers are also alert to give such news.

A buying broker should acquaint a spinner of any lots of cotton on the market and suitable in price and quality.

Averages.—Sometimes a broker will forward small samples of cotton, termed averages, to a spinner, and the spinner may select therefrom and then, by telephone or telegraph, make terms with the seller. "Spot" cotton terms then apply to the transaction.

Frequently clerks or other intermediaries take samples round to the spinning mills, perhaps more especially for Egyptian cotton.

Posting of Sales.—The daily sales may vary between 8000 to 15,000 bales (although 30,000 bales have been posted before now).

An official of the association makes inquiries from 10 to 11 as regards actual and estimated sales of that day and sales after 2.30 the previous day, and at 11 o'clock these are posted in the "Room."

Stocktaking.—At the end of August and of February, members are obliged to state the stock of cotton in hand to the association.

Coloured Cotton Growing.

If experiments now being conducted to grow coloured cotton are entirely successful the United States will no longer be dependent on German dyestuffs. A southern planter has succeeded in growing cotton which ranges in colour from white to deep olive green. The planter is positive that black cotton, sought for ages by spinners and manufacturers, is about to become a reality. This matter is, however, yet in the problematical stage.

Allowances.

The weight of samples shall be 4 ounces per bale.

All cotton shall be weighed full weight and allowance deducted in the invoice.

On American cotton the 4 per cent. allowance covers draft and canvas, but on all other cottons the draft on bales weighing less than 2 cwt. gross shall be 1 lb. per bale and on heavier bales 2 lb. per bale.

Moisture.

If in the opinion of two qualified persons cotton turns out at time of delivery to be damp or wet, and if such arbitrators consider an allowance of at least 10 lb. per bale to be due thereon, 480 bales average, the buyer shall have the right of closing the contract on the market price of the day (other cottons *pro rata*).

Liverpool Cotton Brokers v. Spinning Mills.

Usually, when the representative of a cotton spinning firm attends Liverpool to purchase cotton, he acts through the agency, and with the aid of a "Buying" broker.

A *Buying* broker may be regarded practically as the agent of spinning firms, while a *Selling* broker may be regarded as the agent of merchants or cotton importers.

Both kinds of brokers receive $\frac{1}{2}$ per cent. commission or brokerage on all business done, the cotton merchant paying the selling broker and the spinner paying the buying broker.

Occasionally a person combines in himself the offices of both buying and selling brokers in order to receive "double brokerage," but this practice is not to be commended.

The buying broker not only assists the spinner when he goes to Liverpool, but sends information to the mills as to the state of the market, and attends to the proper delivery, marking and weighing of the bales. The payment for the cotton is made from spinner to the buying broker, who forwards the money to the selling broker and cotton merchant.

The spinner makes his claims for falsely packed cotton through his buying broker.

When a spinner goes to Liverpool he visits the office of his broker, and examines samples which may have been sent there from several selling brokers. As far as practical the buyer judges of the merits and defects of the cottons.

The chief defects may be summarised as follows: Nep, unripe fibres, broken leaf, short and broken fibre, sand and mineral matter, moisture. The samples may "pull" too short, or break too easily.

The effect of each one of these defects is to reduce the value of the cotton in proportion to the extent of which it is present. When cotton is "wasty" the weight of yarn produced from a given weight of cotton is much less than it should be on account of the loss in waste being too great. If we choose to buy cotton that was of irregular staple, dirty and excessively damp, it would be essential that the price per lb. be sufficiently low as to compensate for the inevitable loss on working, or for the lessened price per lb. obtainable for the yarn.

At times cotton has been heavily charged with moisture, and this has led to the adoption in many cases of ovens for testing the amount of moisture from a small quantity of cotton in about 45 minutes to 90 minutes.

Sale Conditions.

The following conditions are printed on all invoices for cotton *other than* Egyptian, East Indian, and Sea Islands.

Cash in 10 days. Claims for falsely packed, damaged, or unmerchantable cotton will be allowed at the value of sound cotton at the date of return, if such return be made and the claim sent in within 10 days and 3 months from date of invoice.

Note.—The above applies also for Egyptian. Indian and Sea Islands are the same, excepting perhaps on the question of discount.

The weight of samples shall be equal to 4 ounces per bale.

In all descriptions of cotton except East Indian, every bale must be sampled, but in East Indian 1 in from 6 to 10 bales.

All cotton to be weighed full weight and allowances deducted in the invoice.

On American cotton the 4 per cent. shall cover draft and canvas, but not bands or hoops. On all other cottons the draft on bales weighing less than 2 cwts. gross shall be 1 lb. per bale; on bales weighing 2 cwts. and over, 2 lb. per bale.

The tare on unpressed Brazilian bales shall be 2 lb. per cwt.

For current and up-to-date quotations, readers are referred to the publications mentioned hereafter:—

Official Quotations.

27TH SEPTEMBER, 1918.

	Ord.	G.O.	F.G.O.	L.M.	F.L.M.
Boweds, $1\frac{1}{16}$	19·92	20·44	21·34	21·97	22·49
Texas, $1\frac{1}{16}$	20·73	21·25	22·14	22·77	23·30
	Mid.	F.M.	G.M.	F.G.M.	M.F.
Boweds, $1\frac{1}{16}$	23·02	23·38	23·65	23·91	24·33
Texas, $1\frac{1}{16}$	23·82	24·1	24·45	24·72	25·14

OFFICIAL VALUE.

	Ord.	G.O.	F.G.O.	L.M.	F.L.M.
American for contracts .	—	—	—	—	—
	Mid.	F.M.	G.M.	F.G.M.	M.F.
American for contracts .	—	—	22·52	—	—

	Ord.	G.O.	F.G.O.	L.M.	F.L.M.
Boweds, $1\frac{1}{16}$.	18·97	19·47	20·32	20·92	21·42
Texas, $1\frac{1}{16}$ . .	19·74	20·24	21·09	21·69	22·19
Memphis, $1\frac{1}{8}$-$1\frac{3}{16}$	24·24	24·74	25·59	26·19	26·69

	Mid.	F.M.	G.M.	F.G.M.	M.F.
Boweds, $1\frac{1}{16}$.	21·92	22·27	22·52	22·77	23·17
Texas, $1\frac{1}{16}$ . .	22·69	23·04	23·29	23·54	23·94
Memphis, $1\frac{1}{8}$-$1\frac{3}{16}$	27·19	27·54	27·79	28·04	28·44

Deduction to be made to obtain the official value of C.I.F. cotton 40 points.

EGYPTIAN: SPOT TRADING VALUES FOR LIVERPOOL STANDARDS:—

	Fair.	G.F.	F.G.F.	Good.	Fine.	Ex-Fine.
Upper . .	21·54	24·13	26·15	28·18	28·74	—
Sakel . .	24·72	28·18	30·19	33·92	36·30	38·60
Brown . .	22·94	25·57	27·31	29·33	32·21	—

EGYPTIAN: QUOTATIONS FOR LIVERPOOL STANDARDS.
(Official value, with corresponding Government type.)

	Fair.	G.F.	F.G.F.	Good.	Fine.	Ex-Fine.
Upper . .	20·51	22·98	24·90	26·84	27·37	—
	17.	14.	8.	2.	1.	
Sakel . .	23·54	26·84	28·75	32·30	34·57	36·76
	53.	49.	*	†	34.	
Brown . .	21·85	24·35	26·01	27·93	30·68	—
	87.	84.	80.	74	70.	

* 25 points over 43. † 50 points over 36.
5 per cent. is the maximum which may be added to any of the above prices.

	Mid. Fair.	Fair.	Good Fair.
Pernam	26·67	28·67	29·67
Parahyba	26·67	28·67	29·67
Maceio	26·67	28·67	29·67
Ceara	26·67	28·67	29·67

SPOT TRADING VALUE.

	G.F.	F.G.F.	Gd.	F.G.	Fine.	S'fine.
Surtee . .	—	—	—	24·75	25·00	—
Broach . .	—	23·50	23·75	24·00	24·25	—
No. 1 Oomra .	19·25	20·25	21·25	22·00	22·50	23·00
Scinde and Bengal . .	—	—	18·75	19·50	20·00	20·50
Tinnevelly . ,	20·00	24·25	24·50	—	—	—

EAST INDIAN OFFICIAL VALUES.

Fine M.G. Surtee	25·35
Fine M.G. Broach	24·60
Fine M.G. Oomrawuttee, No. 1	24·51
Fine M.G. Scinde and Bengal	21·77
F.G.F. Tinnevelly	24·60

Deduction to be made to obtain the official value of C.I.F. cotton 25 points.

IN MEDIUM YARNS, per lb. (in Cop).

4's to 16's twist counts	46¼d. to 48¼d.	36's	weft counts	54d.	to 56½d.
20's ,,	47d. ,, 49½d.	40's	,,	55d.	,, 57½d.
32's ,,	55¼d. ,, 57¼d.	46's	,,	56d.	,, 58d.
34's ,,	55⅝d. ,, 57⅝d.	50's	,,	58d.	,, 60d.
40's ,,	58¼d. ,, 60¼d.	60's	,,	63d.	,, 65d.
50's ,,	61d. ,, 64d.	70's	,,	65¼d.	,, 57¼d
10's to 28's weft counts	45d. ,, 50¼d.	80's	,,	71½d.	,, 73d..
30's ,,	51¾d. ,, 55¾d.				

IN MEDIUM YARNS, per lb. (in Bundles).

20's counts	52¼d. to 53¼d.	40's counts	57¼d. to 58¾d.
32's ,,	54½d. ,, 55½d.	50's ,,	60d. ,, 62d.

BOLTON YARNS—EGYPTIAN, per lb. (in Cop).

60's twist counts	70d. to 72d.	60's	weft counts	68½d.	to 69¾d.
70's ,,	73½d. ,, 77d.	70's	,,	69½d.	,, 71d.
80's ,,	77½d. ,, 81½d.	80's	,,	71¾d.	,, 73¼d.
90's ,,	82⅝d. ,, 86½d.	90's	,,	74¾d.	,, 77¼d.
100's ,,	88d. ,, 92d.	100's	,,	78¾d.	,, 82d.
120's ,,	99½. ,, 104d.				

IN 2-FOLD YARNS (in Cop).

20's counts	50¾d. to 51¾d.	70's	counts	75½d.	to 80¼d.
32's ,,	57d. ,, 58⅛d.	80's	,,	79¾d.	,, 84¾d.
40's ,,	60d. ,, 61½d.	90's	,,	84½d.	,, 89½d.
50's ,,	63¾d. ,, 65¼d.	100's	,,	90d.	,, 95d.
60's ,,	72¾d. ,, 77d.				

IN 2-FOLD YARNS (in Bundle).

20's counts	50⅝d. to 51⅞d.	70's	counts	76d.	to 80¾d.
32's ,,	57d. ,, 58¼d.	80's	,,	80¼d.	,, 85¼d.
40's ,,	60¼d. ,, 61¾d.	90's	,,	85d.	,, 90d.
50's ,,	64d. ,, 65½d.	100's	,,	90½d.	,, 95½d.
60's ,,	73d. ,, 77½d.				

Brokerage: A Cotton Broker must charge—

1. ½ per cent. or 10s. per £100 money for buying or selling cotton on the spot.

2. Or for buying cotton to arrive for delivery which is subsequently received.

3. Or, for selling cotton as per No. 2.

4. A broker may charge $\frac{1}{2}$ per cent. for classing and valuing cotton even if he does not effect a sale.

5. If "spot" cotton be bought and sold in same broker's office only one brokerage may be usually charged and is paid by buyer.

6. The brokerage on "futures" may be $\frac{1}{4}$ or $\frac{1}{2}$ per cent. as per circumstances. The above quotations will always serve as an educational foundation for study and reference, but for up-to-date information the reader will refer to the current issues of the publications mentioned elsewhere.

Associate Membership.

A spinning firm having a responsible Director or Manager to regularly buy cotton, such representative may become an associate member of the Liverpool Cotton Association. Membership, 5 guineas. While an associate member may not enter the "Ring" to deal in "futures," he may yet have his "futures" business transacted by a full member at $\frac{1}{4}$ per cent. commission instead of $\frac{1}{2}$ per cent.

It is understood a mill manager or buyer shall only deal in "futures"—except as a cover—with the consent of his Directors. It has been alleged before now that occasional mill representatives have empowered "futures" speculations, noticed the weekly settlements at 11 a.m. Mondays, managed to delay name from contract until Thursday payments, and then filled in their firm's name to losses, or private name for gains.

Mill Cotton Buying.

"Spot" cotton, C.I.F. cotton and "Call" cotton are the three usual methods for spinners to deal in actual raw cotton for use, with "futures" behind all this for legitimate use as a cover and the payment of weekly settlements to balance purchase of actual cotton or sales of yarn a head. Actual cotton is sometimes "tendered" on a "futures" contract.

It has been stated that the Liverpool Cotton Association have as many as twenty-four forms of contract to cover business under their auspices.

Selection and Purchase of "Spot" Cottons by Spinners.

The spinner's representative usually sends word to his buying broker when he is coming, and may indicate the general nature of his requirements unless the broker knows these. The staff of the selling brokers may be waiting in force near the Exchange and the broker's offices by about ten o'clock each morning, and on these

being informed, for a good customer, numerous samples, 50 to 100 lots, all of the general style wanted, are soon on tables of the buying broker. After suitable examination and bargaining, a selection and purchase is made. Usually the bulk of the cotton is ready for immediate delivery, but if delayed the buyer may either cancel or may claim the average date of delivery to be the date of the invoice. Inferior bales may be laid aside at the scales. Ten days allowed for payment, 5 per cent. discount for sooner payment, 5 per cent. charged for delay in payment after the ten days, in addition to insurance and warehouse charges. Also some risk of trouble with the brokers, merchants, or Cotton Association.

Light and Shade.

"Spot" cotton is usually bought in Liverpool during the morning, the same mill managers often reaching Manchester yarn market in time for high change same day.

Light and shade vary with the time of day and the position and direction of office windows.

It is well understood that a north light is best, 10.15 to 11.15 a.m. approximately giving best effects.

The same cotton in same place examined at two o'clock or after same day might appear a different shade.

Method of Selection.

The judging and selection of cotton from samples is a work which comes directly into the duties of the head managers and the most responsible officials of a mill, and is undoubtedly a matter of great importance, as it vastly affects the spinning, the quality of the yarn, and the profit or loss of the firm. In actual judging on a system we may first determine the grade of the cotton as indicated by its general appearance and cleanliness. Then the staple or length of fibre may be judged by pulling between the fingers and thumbs of both hands, the same operation affording also an indication of strength of fibre, and possibly also uniformity. Afterwards by shaking a sample, some idea of the amount of sand may be obtained. Comparison of tests or samples may aid in judging the uniformity. Colour has little effect on spinning, and in many cases does not matter much in other respects, as for example in warp yarn which has to be sized; so it could be in most cases—though not all—placed last in order. Length of fibre comes before strength, as a rule, as for example, Sea Islands fibre is far more valuable than others, and yet is no stronger in the fibre. Excessive dirtiness would probably depreciate a sample of cotton in price more than anything else, but if the staple is long it need not be a bad

spinning cotton. No definite arrangement can be given to suit all requirements. On a certain day in June, 1922, a certain mill manager informed the author he had just seen all the following cottons bought for 38's twist: Californian, Peruvian, Tanguis, Oklahoma, and Texas.

To summarise, price or value per lb., and spinning qualities of cottons do not always run concurrently, since an extremely dirty cotton would be much depreciated in price, and yet if of decent length and strength of fibre, might spin better than a clean but weak cotton. The spinning qualities in a general way we might give the order as follows :—

(*a*) Length of fibre; (*b*) strength of fibre; (*c*) cleanliness; (*d*) colour; (*e*) development in twist; (*f*) uniformity.

For price per lb. we might state the order in many cases the same way and in other cases with cleanliness first instead of third.

Cotton Grading.

There are several qualities which are keenly noticed when selecting cotton; such as cleanliness, colour, smoothness, fineness, strength and length of fibre. Stapling is the market term applied to judging the length and strength of fibre, while grading more particularly alludes to such features as the first two named above, or the general appearance and brightness of the cotton.

The chief grades of American cotton are: Ordinary (Ord.), Good Ordinary (G.O.), Low Middling (L.M.), Middling (Mid.), Good Middling (G.M.), Middling Fair (M.F.). By means of the prefixes "strict," "fully," and "barely," these full grades are divided into half and quarter grades. For example, we have Barely Middling, which is a quarter below Middling; Strict Middling, which is a quarter better; and fully Middling, which is a half-grade better than Middling, while Barely Good Middling would be three-quarters grade better than Middling, or a quarter-grade below Good Middling. Standard samples of the grades are kept in the offices of the Liverpool cotton brokers, but are liable to alteration with each season's crop.

Starting with lowest grade the usual Liverpool classification for Egyptian cotton is as follows, although on another page it will be seen that war-time cotton control divided Egyptian cotton into more than 100 types.

Usual division: Fair, Good Fair, Fully Good Fair, Good, Fine, Extra Fine.

Fully Good Fair has usually represented the basis for Egyptian cotton.

Liverpool classifications for other cottons are given below.

Brazilian, and Peruvian.—Mid., Mid. Fair, Fair, Good Fair, Good, Fine, Extra Fine.

Indian.—Good Fair, Fully Good Fair, Good, Fully Good, Fine, Superfine.

In "spot" cotton transactions, delivery must be to sample, but in a transaction in American "futures" based on Middling, the seller may tender the lower qualities Low Middling, or Fully Good Ordinary, and offer a price compensation.

TOTAL COTTON CROPS.

American. in 1000's Bales.	Avg. Price, Mid.	Egyptian. in 1000's Cantars.	Avg. Price, F.G.F.
1916-17 . 12,976	12·33	1916-17 . 5,126	21·56
1915-16 . 12,953	7·51	1915-16 . 4,605	10·42
1914-15 . 15,067	5·22	1914-15 . 6,347	7·34
1913-14 . 14,885	7·27	1913-14 . 7,684	9·45
1912-13 . 14,129	6·76	1912-13 . 7,533	9·79
1911-12 . 16,043	6·09	1911-12 . 7,424	$9\frac{9}{10}$
1910-11 . 12,132	7·84	1910-11 . 7,574	$10\frac{3}{4}$
1909-10 . 10,651	7·86	1909-10 . 5,001	$13\frac{1}{8}$
1908-09 . 13,829	5·50	1908-09 . 6,751	$8\frac{7}{16}$
1907-08 . 11,582	6·19	1907-08 . 7,235	$8\frac{13}{16}$

East Indian.		Brazilian.	
1916-17 . .	4,836,000 bales.	1916-17 . .	293,000 bales.
1915-16 . .	3,819,000 „	1915-16 . .	282,000 „
1914-15 . .	5,209,000 „	1914-15 . .	324,000 „
1913-14 . .	5,201,000 „	1913-14 . .	448,000 „
1912-13 . .	4,385,000 „	1912-13 . .	463,000 „
1911-12 . .	4,178,000 „	1911-12 . .	316,000 „
1910-11 . .	4,537,000 „	1910-11 . .	354,000 „
1909-10 . .	5,317,000 „	1909-10 . .	225,000 „
1908-09 . .	4,779,000 „	1908-09 . .	314,000 „
1907-08 . .	4,445,000 „	1907-08 . .	341,000 „

The stock of cotton in Liverpool is officially taken at the end of February and end of August.

Terms Applied to Cotton Features.

(*a*) The term "staple" is practically synonymous with the term "length of fibre," but it may imply strength as well.

(*b*) Rusty cotton or stained cotton may be due to defective

baling, and the cotton being exposed to bad weather during transit, this affecting the outer portions of the cotton bales.

On the other hand it may be the result of unsuitable weather conditions before the cotton is picked, as for instance open and ripe bolls of cotton being alternately exposed to very wet days and hot days before picking. Staining of the cotton may possibly be caused by crushing of the seeds in ginning.

(*c*) The term "wasty" cotton partly explains itself. It means the presence of an excessive proportion of short fibre and undesirable matter of various sorts, and involves the expense of trying to get this stuff out in the earlier processes in the mill, more or less bad spinning, and great loss in waste.

Length of fibre.

Staple means strength and length as tested by hand from a bunch of fibres.

Hard cotton may mean a certain denseness in American or Egyptian cotton.

Harsh. Grating and rough to the feel instead of smooth, soft and silky.

Smooth. A nice feeling, silky fibre.

Stained. Mostly by rain, frost, or seed-crushing in the gin. Depreciates value.

Spotted may mean unevenly distributed, or tinged or green stain, and reduces cotton value.

Buttery looking. Too creamy for some purposes.

Of good bloom. Means a healthy, bright appearance.

Blue cotton. Some of the lowest qualities of American have this appearance when placed side by side with ordinary American. Depreciates the value, due to weather, imperfect development, and position of growth.

Rusty or country damaged. Due to bales subjected to weather exposure.

Falsely packed. Inferior sorts placed inside the bales. Excessive tare weights may be claimed for.

Terms Used in Cotton Transactions.

1. *Type samples.* Samples kept for reference in cases of dispute, or from which C.I.F. cotton may be purchased.

2. "Spot" cotton. Cotton actually in Liverpool or Manchester.

3. *Actual samples.* Samples taken from the actual bales which are purchased and used for convenience in buying and selling. Samples of about 4 ounces from about every 5 bales, so that 100 bales might be represented by about 20 samples.

4. "Spot" cotton is cotton actually in the warehouse ready for

prompt delivery and the buyer sees actual samples from these bales.

American "Spot" Cotton Terms.

Gross weight of bales less :—
(*a*) Actual weight of bands or 10 bands = 11 lb.
(*b*) 4 per cent. for tares.

Example :—	lb.
	50,000 gross
Less 550 bands (band = $\frac{10}{11}$ lb.)	605 bands
	49,395
Less 4 per cent. tare	1,976
	47,419 net weight of cotton.

(*c*) Invoice direct from seller to broker.

"Call" Cotton.

The system of purchasing American cotton on "call" is now very largely adopted indeed. The spinner may purchase sufficient cotton of a sort to last him six weeks or so and arrange for so many bales weekly, or for "fixing" immediately yarn sales are effected. The "basis" is fixed, for example, at so many "points on." Suppose a spinner has bought 600 bales of a certain cotton to be "fixed" as per sales of yarn. The cotton may be quoted at 9d., 9½d., 10d., or whatever is going, and the spinner agrees to, pay 200 "points on." One week afterwards he sells yarn on Manchester Exchange requiring 300 bales of the above cotton. The spinner immediately acquaints a cotton broker's representative on Manchester Exchange, or 'phones or wires to Liverpool to fix this 300 bales at current price, but always on the 200 "points on" basis. If the ruling quotation of the day is 9½d. the spinner pays 11½d. per lb. for the cotton, or if 10d. he pays 1s. Confirmation in writing as soon as possible.

If, for example, 100 bales per week are to be delivered on a stated week-day, then the basis of 200 "points on" is added to the quoted price for the basis cotton, on the day of delivery in each week.

"Call" cotton enables a spinner to obtain and commit himself definitely to the purchase of a stated quality and quantity of cotton, and does not fix the actual price of the cotton but only the basis; and yarn should go up or down in sympathy with cotton prices,

thus ensuring steady business. The spinner may fasten his desired cotton for some time ahead, without having to pay down for it before he sells his yarn and without risking the chance of getting correct cotton when wanted.

The purchase of cotton upon "call" is one of the chief departures from the plain definite purchase of "spot" cotton and obtaining quick delivery, and paying inside the limited number of days officially allowed. Business in "call" cotton is somewhat largely entered into by spinners of American cotton, and is often of considerable help to the spinners. A spinner may examine very many samples of cotton, and may find a good quantity of cotton which is likely to answer his purpose very well. There may be a great deal more of this cotton than the spinner can afford or may think it wise to purchase straight off as "spot" cotton, but for all that he would like to fasten or obtain a "call" on the cotton. The spinner buys the cotton on "call." For example, he may agree to pay 100 "points on," which means that the basis of the price is fixed, but not the actual price itself. The "points on" means that when the cotton is called the spinner will pay 100 points above the market price of "futures" for that day. Assuming he selects the cotton on 20th April and agrees to "call" the cotton some day in June, and on the 10th June he takes a good contract for yarn requiring that kind of cotton, he immediately notifies the broker the cotton is to be called in. By means of "call" cotton a spinner ensures himself to have a supply of the right kind of cotton when required, without taking the risk of great fluctuations in prices, without having to store the cotton much ahead, without having to pay money down at time of bargaining, and without paying interest on the money. "If cotton is sold on 'spot' terms the 'call' must be made not later than thirty days after the invoice date. If cotton is sold to be called during any month without any particular date being stipulated for the 'call,' such cotton must be called before noon of the last business day but one of the month, in default thereof the price shall be fixed on the basis of the official midday value of the said last business day but one. If cotton is sold to be called on or before a certain date, it must be called before noon of that date; in default thereof the official midday value of that day shall form the basis of the price; but if the last day of 'call' is also the last day of the particular month upon which the price has to be fixed, then the price of the uncalled cotton shall be fixed by arbitration on the basis of not less than two points and not nore than twelve points over the official closing value of that outgoing month. Cotton sold on 'call,' unless otherwise stipulated at the time of sale or agreed to later by the seller, shall be called in one lot or in lots of not less than 100 bales."

C.I.F. and 6 per Cent. Cotton.

"Siff" Cotton.—The term "spot" cotton is applied to the cotton actually stocked in the market, as, for example, in Liverpool, and actual samples of which may be inspected by the purchaser. The terms for "spot" American cotton are ten days' time allowance before payment, 5 per cent. per annum interest allowed for payment inside of this time limit, or same interest charged for any delay over the ten days. Four per cent. for tares. 6d. per bale charged for conveyance from Liverpool warehouse to station at Liverpool, with higher charges if less than 10 bales forwarded. Half per cent. commission to the buying broker, 11/13 lb. weight for 10 bands. Egyptian "spot" cotton terms differ slightly in allowances for discount, D draft, and weight of bands. The term C.I.F. is short for costs, insurance, and freight. Such cottons are not actually in Liverpool at date of purchase, and probably the buyer does not see actual samples, but there is an understanding that the cotton shall be equal to certain standards or certain type samples. Dealings in C.I.F. cotton provide one method of buying cotton ahead, but with longer time limits for paying than obtain with "spot" cotton, and with some guarantee of obtaining the sort of cotton required at the proper time. In a mild sense a spinner dealing in C.I.F. cotton becomes a kind of cotton importer, and the seller of the cotton in the foreign country pays costs, insurance, and freight up to the port of Liverpool, from which point the purchaser takes the responsibility, and pays dock dues, porterage, forwarding, and railway charges. The cotton may be taken directly from ship to mill, but sometimes a broker is employed to sample and deal with the cotton. The 6 per cent. allowance is made to the spinner for tares and moisture.

For American cotton sold on cost, freight and insurance, port bill of lading, the following is an epitome of some of the rules of the cotton association: "When sold for 'prompt' shipment such shall not be earlier than the date of contract nor later than fourteen days after. When sold 'shipping' or 'shipped,' such shipment shall be within fourteen days either before or after the date of contract. Failure of seller within specified time to render invoice and make declaration of particulars in bill of lading, the buyer shall have the right of closing the contract. If later on the buyer can prove that the particulars are not in accord with the contract, the matter may be arbitrated upon. All notices and declarations due on holidays fixed by the association shall be made on the last business day preceding. Should the seller be declared a defaulter before the buyer can obtain a legal transfer of the cotton or should the latter suspend payment, the contract shall be closed upon terms fixed by the committee. Claims for falsely packed, or unmerchantable cotton shall be allowed, if properly substantiated at the value of the sound cotton

on the day of return, if such be made and the claim sent in within two months from the last day of landing. Claims for allowance for internal damp shall be made within twenty-eight days from date of landing. Net weight shall be ascertained by weighing the cotton in Liverpool before sampling, due notice of the weighing having been given in writing to the seller. Total expenses of weighing to be divided between buyer and seller. Allowances to be made for ship's pickings. Should the differences exceed 5 per cent, then the difference shall be settled for mutually at the market value on the last day of landing of cotton contracted for. Should the weight of canvas exceed 4 lb. per cent., then the buyer shall have the right to claim for such excess at invoice price. If the quality of the cotton tendered, or if any lot included in it, shall not be in accordance with the contract, the buyer shall have the option of taking such portion with the allowances made by the arbitrators, or of returning it to the seller, and closing the contract for such portion by invoicing it back at a price to be decided by arbitration, which shall not be more than $\frac{1}{100}$d. per lb. above the "spot" value of the cotton contracted for."

Dealings in "Siff" (C.I.F.) cottons may be undertaken by spinners as a method of covering sales of yarn ahead without having to pay for the cotton immediately and without immediate delivery of the cotton.

C.I.F. System for Egyptian.

Suppose a spinner of Egyptian yarns desires to ensure a regular supply of suitable cotton for his counts and class of yarn for many months ahead. There is not sufficient "spot" cotton available for his purpose, or he may not have storage room, or not enough money or capability of getting a sufficient bank overdraft. It may happen he wants to speculate in "spot" cotton without having previously sold his yarn.

C.I.F. cotton often offers a convenient business arrangement, and a spinner may often enter a contract on C.I.F. terms. The spinner may do business with a firm in Alexandria through British representatives. The shipper pays all costs up to Liverpool or Manchester. The cotton is guaranteed to be equal to type sample which may be kept sealed until the cotton arrives.

Reimbursement by shipper's drafts at three months' date from bill of lading for invoice amount; the buyer guarantees the due protection of the drafts on presentation and payment at maturity.

Before now cotton has reached English mills from Alexandria in four or five weeks' time, gone through all mill processes and become yarn, in another three or four weeks, delivered to weaver and made into cloth, before the three months' expiry. The spinner sells

his yarn to home firms on ten days' credit, 2½ per cent., or sometimes cash 3 per cent., and has often received payment for the yarn before having to pay for the raw cotton. Such spinning firms need to be well established and well guaranteed to the cotton shippers.

C.I.F. Contract Items.

Illustration Example.

LIVERPOOL COTTON ASSOCIATION, LTD.

Cost Freight and Insurance Form for American Cotton Port Bill of Lading.

"LIVERPOOL,
"27*th February*, 1922.

"TO MESSRS. SPINNING CO., LTD., OLDHAM MILLS.

"We have this day, on the terms of the rules, bye-laws, and Clearing House regulations of the Liverpool Cotton Association, Ltd.:

"Sold you 200 bales of American cotton, averaging per 100 bales gross, 48,500 lb. for all descriptions excepting Texas (which shall average 50,500 lb. per 100 bales gross—a variation of 5 per cent. allowed).

"At 1s. per lb., cost, freight and insurance.

"To be invoiced at American actual gross weight, less an allowance of 6 per cent. Net weight (that is, actual weight of bales, less bands, canvas and draft) guaranteed by sellers equal to net American invoice weight. Settlement to be made with mutual allowances as to weight.

"To be shipped per s.s. 'Friendship,' from New Orleans via Atlantic Ocean, during the month of May, 1922.

"Invoice with full particulars to be rendered to the buyer within four weeks of the date of Bill of Lading.

"Marine insurance to be provided by the seller, covering particular average and 5 per cent. in excess of invoice cost, but any amount over this shall be for sellers' account in case of total loss only. Cost of stamping documents borne by seller.

"Buyer guarantees due protection of drafts on presentation and payment at maturity, or, the date of invoice shall be the 75th day after Bill of Lading, payable in Liverpool.

"Payment shall be made in exchange for shipping documents on, or (at buyers' option) before arrival of the vessel or vessels; or failing previous arrival, not later than the due date, by cash, less customary rebate for any prepayment.

"Payment shall be made in exchange for delivery of the cotton as it may arrive (the buyer paying all Liverpool charges) by cash,

less customary rebate for any payment made before due date, or plus interest at 5 per cent. per annum, for any payment made thereafter. If any cotton declared against this contract be lost in transit the contract for such cotton shall be at an end, but the seller shall collect for the buyer the excess agreed to be insured above the invoice amount. In event of damage, covered by Marine Insurance Policy, the seller shall collect the amount of same from the underwriters, on buyer's account.

"No allowance to seller. Should arbitration be demanded by the buyer the cotton shall be subject to mutual allowances, except in the case of average shipment. Should any lot prove inferior the buyer to have the option of accepting the cotton, or of returning it to the seller."

Cotton Market Notes.

1. In C.I.F. the 6 per cent. is deemed by some spinners too much on a heavily pressed bale.

2. On a C.I.F. contract of 50,000 lb. weight the seller is allowed to vary 5 per cent. up or down from this total weight, so if cotton has gone much dearer he may deliver only 47,500 lb., or if much cheaper, 52,500 lb.

3. The American C.I.F. seller may add 1 per cent. to the dry weight (for franchise?)

4. The double month idea or position, such as January-February, arose from difficulties in sailing vessels so much used formerly, and inability to guarantee more accurate delivery. Steamships now do better, and a one month position may be taken.

5. C.I.F. transactions in Egyptian are very moderate compared with American.

6. A large sale may affect Egyptian prices much more so than a similar sale in American owing to different size of crop.

"Futures" Tendered.

7. It is possible to deliver cotton against a "futures" contract, but is deemed a shabby trick as distinct from "paying differences."

A man may have abundant funds to pay differences, and yet be utterly unable to take cotton deliveries and pay therefor.

In Egypt tallers of 4s. 4½d. or dollars per cantar of 99 lb.

In Bombay rupees per candy of 748 lb.

Parity or rate of exchange vastly affects these.

Le Havre, in France, is their important cotton market.

In America, cents per lb., and you must take note of difference in basis of Low Middling, etc.

Twenty-one million bales, a modern total pre-war. Linters = 1,500,000 bales, war-time requirements.

In 1918	U.S.A.	59 per cent.
,,	British India	15 ,,
,,	China and Corea	12 ,,
,,	Egypt and Soudan	6 ,,
,,	South America	3 ,,
,,	Russia	3 ,,
,,	Persia	2 ,,
		100 per cent.

The Straddle.

Straddling operations are frequent in "futures" transactions. A contract is made on 48,000 lb. weight. A straddle means that a person sells "futures" for one position, such as May-June, and purchases for a different month or position, such as August-September. He does this in the hope or belief that prices will go up for the month he buys or down for the month he sells.

EXAMPLE OF STRADDLE.

On 5th Nov. for Feb. at 14·40d. he sells.	After second deal he has Net result on two deals of
,, ,, ,, Apl. at 14·00d. he buys.	(*a*) He sold at 14·40d.
	And bot. at 13·50d.
On 5th Dec. for Feb. at 13·50d. he ,,	·90d.
,, ,, ,, Apl. at 13·40d. he sells.	
	The difference of ·90 leaves him to gain £180.
	(*b*) He bot. at 14·00d.
	Sold at 13·40d.
	·60d.
Net gain is £60 on all the above transactions.	Loss of £120.

Cotton market expressions mostly referring to "futures":—
"Active" means good business.
"Dull" ,, little.
"Firm" ,, prices steady.
"Strong" ,, distinct advance in prices.
"Easy" ,, prices getting weak.
"Feverish" ,, excited market.
If a man is "long" he has over bought.
,, ,, "short" ,, under-covered.
"Hedging" means covering or making transactions opposed to previous commitments.

A "jobber" is a member of the Cotton Exchange who chiefly makes his living by buying and selling "futures."

"Tenders" or "dockets" represent actual deliveries against "futures" contracts, but "futures" are mostly paper transactions and settled up by paying differences.

A "bull" buys because he considers prices will go up.

A "bear" sells „ „ „ „ down.

Transactions in "Futures."

Dealings in "futures" may be beneficially used by a spinner as a "cover" or protection for sales of yarn ahead, and by the aid of such a contract a spinner may sell his yarn for months ahead, without having the actual cotton in hand to cover the sales, and yet without running the risks involved in extreme variations in the market prices of cotton. Taking American cotton as an example, "Middling" may be taken as a basis, and the spinner buys a "futures" contract at the ruling prices of the day and to exist in a manner that will cover his sales of yarn. Neither the buyer nor the seller of a "futures" contract need desire to deal in the actual cotton, but only in regard to the values. Suppose a spinner is holding a "futures" contract and the prices during the week move up ½d. per lb., then, on the "weekly settlements" basis insisted upon by the Cotton Brokers' Association, the seller must pay the spinner the "differences," whereas if the cotton has become cheaper the spinner must pay the seller. The real safeguard to the spinner consists in the close sympathy which usually exists between "futures" and "spot" cotton, so that as a rule if the spinner has to pay on his "futures" contract in any given week, probably he is able to purchase his weekly supply of cotton at a proportionately reduced cost, so that what is gained or lost on one transaction is at least approximately balanced by the other one. His "futures" cotton should be purchased in such a manner that in proportion as he purchases cotton for his actual requirements so he may part with his "futures." It is quite clear if a spinner sold yarn for six months ahead and did not "cover" with purchasing cotton at all or in any way, then he would be taking the risk of prices going up and his firm sustaining heavy losses. It is quite true, of course, if prices of cotton went down in the meantime, the firm would make correspondingly large profits, but this is speculating more than regular cotton spinning. There is usually not much difficulty in finding buyers when there are sellers of "futures," and it may be advisable for a *bona fide* cotton importer to sell "futures" as a protection just as it may pay a spinner to buy the same. Naturally a great deal of business is done in cotton "futures" by people who simply speculate on prices moving up or down, and who really neither have, nor want

to have, anything to do with the actual use of the cotton in producing yarn and cloth. They pay or receive differences.

"Futures" Contract for Actual Cotton.

Bought on "weekly differences" and "weekly settlements," which means if cotton goes up ½d. in the week the seller pays this ½d. to the buyer, and if cotton goes down ½d. the buyer pays this to the seller.

An importer buys actual cotton in U.S.A. at 16d. per lb., 1000 bales in lot; sells 1000 January "futures" at 16d. For "futures" transactions 100 bales to equal 48,000 lb.

		Starting Price.	Seller Pays.	Buyer Pays.
Sells 1000 at 16d.	Nov. 1	16 pence	—	—
Price on	,, 8	16·50 ,,	£1,000	—
,,	,, 15	16·25 ,,	—	£500
,,	,, 22	15·75 ,,	—	1,000
,,	,, 29	15·00 ,,	—	1,500
Delivers the 1,000 bales	Dec. 6	15·25 ,,	£500	—
			£1,500	£3,000

He paid 16d., sells at 15¼d., and loses £1,500, but has gained it in "futures."

"Weekly settlements" compelled by Liverpool Brokers' Association to prevent any individuals being over committed.

Brokers charge ½ per cent. to outsiders and ¼ per cent. to members of Liverpool Cotton Exchange.

A point was formerly $\frac{1}{64}$, but is now $\frac{1}{100}$d. in England and $\frac{1}{200}$ or $\frac{1}{100}$ cent in U.S.A.

Cotton Cornering.—A "squeeze" or cotton corner implies a buying up of all available cotton for a certain period so as to force the prices up. It is a manipulation usually entered into by a group or pool of "bulls," who buy more "futures" cotton than is expected to be available in a specified month. When the contract falls due they actually receive and pay for all the cotton offered for delivery, and when the stock is exhausted they compel those, who have sold short and have not delivered, to buy the cotton at a high price. To be *short* is to have sold "futures." To be *long* is to have bought "futures."

Products of a Fine Spinning Mill.

One of the best forms of fine spinners has advertised its productions as follows:—

"Spinners of super-combed Egyptian and Sea Island yarns, 10's/70's on ring tube, 60's/300's on mule cops.

"Doublers of super-combed Egyptian and Sea Islands in all counts up to 400's/2 and double-spuns in 90's/1 to 140's/1, as suitable for the manufacture of fine muslins, crochet, embroidery, dress goods, voiles, velvet, net, lace, gloves, hosiery, tyre fabric, aeroplane, balloon and airship fabrics, also yarns for mercerising.

"Yarns supplied on mule cops, on ring tubes, cheeses, bundles, pirns, and beams."

This quotation is made to show the kind of markets the best fine spinners cater for.

Industrial Research Fatigue Board.

In 1920, what might be termed official investigations were made in regard to fatigue in cotton mills, also individual differences in output as between different workers under similar conditions, as well as comparisons between calculated and actual output. More differences were found in ordinary looms than in Northrops, and more in drawing-in or twisting-in than elsewhere. As any experienced person in cotton mills might well expect, such investigations apparently failed to lead anywhere or attain any definite object of any value to the industry itself. These matters are constantly under the direct notice and inquiry of the permanent managers and overlookers of our mills, who must be ever seeking whether better results can be obtained from either machines or operatives. If frame tenters, ring-spinners, mule-spinners, winders or weavers, do better or worse than the average over any extended period, it is not long before the persons concerned know something about it. Speaking generally, mechanical efficiency is so well developed in cotton mill machinery, that the human factor becomes of less importance than in some trades, but, nevertheless, every foreman is always watchful in regard to this factor and knows he cannot be careless in the matter.

Names.

Mosquito Net may be described as a fine gauze cloth woven from rather fine yarns mostly bleached. Picks mostly in "fines" with yarns from 38's/60's.

Mohair.—The wool obtained from the Angora goat. This wool is fine, long, lustrous, wavy, and white. The term Mohair is often applied to cloth woven from Mohair yarn.

Mildew.—Often a bugbear in the cotton trade. May appear in cotton bales when a bucket of water has been emptied into the middle of a bale at the press. Mildew is a fungoid growth caused

by fermentation set up by moisture and heat. Has often appeared in yarn stored too long in ordinary damping cellar, or conditioned with certain chlorides.

Probably mildew has appeared in cloth even more often than in raw cotton or spun yarn due to the practice of storing cloth in heaps so that the pressure prevents the circulation of air and causes heat. Materials used in sizing are sometimes conducive to mildew, and medium sized or heavy sized cloths are most likely to suffer from mildew. The most serious conditions in regard to mildew are fostered whenever wet or damp material is placed for some time in a warm position.

Sewing Cotton.—In December, 1919, when prices were about at their highest, and many shareholders of cotton mills had profited the turn-over of their concerns—a shareholder in the largest firm of sewing thread manufacturers wrote as follows: "Sewing thread is largely made out of 80's twist. Before the war this particular quality of twist was 2s. per lb., now it is 17s. 6d. per lb.—nearly nine times as much. Have the thread makers increased their prices nine times? Certainly not. They have been content with a moderate advance, and had it not been for great organisation the thread price would have been much more."

Knitted Goods.

There has always been more or less competition along certain lines, between knitted and woven goods, and during recent years it has become apparent that the knitting trade has approached nearer to the weaving trade in some directions, and has in this way increased its competition. So far as the spinning mills are concerned both the hosiery or knitting, and the weaving trades require cotton yarns as well as wool and worsted. The simple character of an ordinary machine knitted fabric, and the continuous productive operation of the knitting machines, as compared with the intermittent movements of a loom, give distinct points in favour of many lines of knitted goods.

There is difficulty in knitting very many fine fabrics such as are woven by the loom, owing to the space required for loops in the fabric, and there is also trouble in keeping down the weight of a knitted fabric unless it is a very open one.

Strong efforts are being made to produce finer fabrics on knitting machines.

Knitted fabrics are like woven ones in respect of very often being submitted to finishing processes which may give a greatly improved appearance.

The great production of knitting machines may be increased by using any number of weft threads, as many as 80 at once, although

this diminishes the quality of the goods. One authority says of knitting machines: "They could make 15 to 18 inches of fabric, 20 inches double width, in one minute, and one girl could look after four machines. One girl could look after eight machines at a time, and make up 120 dozen pairs of hose in a week."

CHAPTER III.

TRANSACTIONS IN COTTON YARN. MANCHESTER EXCHANGE. SOME FEATURES OF COTTON YARN.

Manchester Royal Exchange.

GREATEST buying and selling centre in the world for cotton yarn, cotton cloth, cotton textile machinery, and all kinds of accessories to these industries.

First Exchange built in 1729, second in 1809, third 1867 to 1874, latest and greatest extension commenced June, 1914, opened by the King and Queen, 8th October, 1921.

Now the world's greatest place of assembly of traders for business purposes. Membership about 12,000.

The centre of the largest industrial area in the world having, within a radius of 50 miles, a population of 9,000,000.

The great Hall occupying almost 8,000 square yards is the chief feature, and around this are suites of offices occupied by business firms. Post office, telegraph office, very extensive telephone department, reading-room, and cable companies.

At time of opening there were about 2,000 textile firms representing on this Exchange 800,000 looms and 60,000,000 spindles. Three-fourths of the cloth produced by the looms was exported.

In 1809 there were, 1,543 members, in 1841, 2,543, in 1874, 6,663.

In addition to the direct cotton industries there are many others represented, many of which are more or less subsidiary to spinning, weaving, bleaching, dyeing and textile machine-making. For example, iron and steel, alkali, aniline, chemicals, collieries, rubber, woollens and worsteds, insurance, wood-pulp, transport.

Area of building 8,222 square yards, nearly all of which is occupied by the Exchange floor in the large Hall surrounded by 250 offices.

The great Hall has at the top two large and four smaller domes which light up the Hall.

There is a private wire connecting the Manchester Exchange with the Liverpool Exchange, giving throughout the day at Manchester all the quotations of the Liverpool Cotton Market. The chief of these quotations are posted on the two large cotton boards

each 62 feet long × 9 feet high fixed 45 feet above the floor level in the Exchange Hall.

At the time of writing, within the Exchange buildings are the rooms of the Chamber of Commerce Testing House, the offices of the Master Cotton Spinners' Federation, the British Cotton Growing Association, and many business firms.

There are thirty-eight business premises on the street frontages.

Bounded by Market Street, Cross Street, Bank Street, St. Ann's Square, and Exchange Street.

Two main entrances and four subsidiary ones.

Staircases and passenger lifts to all parts of building.

Lighting, heating and ventilation conducted on latest principles.

There is a basement and a sub-basement.

Architects, Messrs. Bradshaw, Gass & Hope of Bolton.

Manchester is the great distributing centre for the cotton trade. A great railway centre and aided in its transport and shipping work by the Ship Canal, opened in 1894 by Queen Victoria. It is 35½ miles long, 26 feet deep, 120 feet wide, with tremendous docks, storage and facilities for handling, collecting, and distributing goods.

Manchester's Railway Facilities.

Manchester offers very great facilities indeed, for both passenger and goods traffic by railway. Such important railway lines as the Midland, Lancashire and Yorkshire, Great Central, London and North Western, and Cheshire lines, have long had important and spacious stations and warehouses in Manchester. The fusion of several companies under one central control—at present in active process—bids fair to increase and improve the already wonderful facilities.

Very direct and quick connections may be made by railway between Manchester and the great industrial centres of the Midlands towards the south and Scotland on the north, as well as to all the principal towns and ports of the kingdom, such as London, Liverpool, Southampton, Bristol and Hull, for example.

Abundant facilities are available for the collection and delivery of goods, and the combined railways occupy immense and convenient spaces in various parts of Manchester, for warehousing and storing almost all kinds of goods.

Take for illustration the Midland Railway Company, in their depôts at Ancoats Goods Station and Ashton Road Station. The Ancoats Goods Station in June, 1922, was stated to be six acres in extent, with extensive dry warehouses for storage of traffic for shipment, cotton bales, cotton yarns, cloth, grain, etc.; up-to-date power cranes, lifts, and other modern appliances for dealing with

freight traffic expeditiously; cool cellars for storing perishable goods.

An electric crane at Ashton Road Station has a span of 45 feet, and a lifting capacity of 30 tons.

The combined railways have many equivalent stations in and about Manchester. On 1st December, 1922, railway charges for goods were distinctly reduced.

Manchester Ship Canal.

The construction of the Manchester Ship Canal, a deep waterway 35½ miles long, between the City and the sea, has given Manchester an international trade, helped its world-wide reputation, and made it one of the first ports in the kingdom. No port has better dock accommodation and appliances, and few ports have such complete and modern equipment. Probably no other port in the world can boast of such a favourable geographical position. It is situated in the very heart of an area which, industrially, is the greatest in England. Within a radius of 25 miles of the city the population approximates to 4,500,000, and within a radius of 50 miles to over 10,000,000. The population of Lancashire is almost equivalent to that of the whole of Scotland, and a little more than that of Ireland. It exceeds that of the Commonwealth of Australia, and with the West Riding has a larger population than all Canada. Manchester and Salford have about as many inhabitants as New Zealand, and there are as many people within carting distance of the docks as there are in all Denmark. The rise of Manchester to its present commercial position has been aided greatly by the construction of the Manchester Ship Canal. Nearly thirty years ago Manchester was an inland town. Now, however, it is an important port, and in the value of its import and export trade it is the third port in the kingdom.

Buying and Selling of Cotton Yarn. Some Features of Yarn.

Yarn selling is not necessarily the duty of any class of individual. Small concerns sometimes find it pays to place their selling of yarn in the charge of a responsible agency, although many concerns of only moderate size have their secretary or manager to do the selling.

A very common plan with important spinning concerns is for the secretary to be also the salesman, and for the general manager to help the salesman on the chief market days of Tuesday and Friday.

Very large spinning firms may employ a salesman who does very little else.

Sometimes it is the general manager who is also the chief

salesman, and he may have his mill work helped by an assistant inside manager.

Apart from all this there is a small army of more or less independent yarn agents, not fast with any one mill in particular, who sell on the usual commission for any firm if need be, either on guarantee or non-guarantee terms. When trade is booming and credit good all round, many spinning firms do not see the need of paying the ½ per cent. for guaranteeing payment.

Assuming a large firm to be spinning about average 26's from American cotton and in two mills having well over 200,000 spindles, the production in a 48 hours' week may reach 200,000 lb. of yarn per week. A difference of ½d. per lb. in price has not been deemed very much in some recent years, yet it means a difference of over £400 on the week. Although discount has long since been stopped on raw cotton, it yet obtains in yarn transactions.

Pre-war, a difference of ¼d. per lb. on American yarns was deemed a good difference.

Agency Terms.

1. Payment in fourteen days, 2½ per cent. discount. Direct sale.
2. Payment in fourteen days, 2½ per cent. discount plus 1 per cent. commission to a non-guaranteeing agent. Total 3½ per cent.
3. If the agent guarantees payment he is allowed an extra ½ per cent. giving a total reduction in payment to the spinner of 4 per cent.
4. Sometimes an agent or customer is allowed 3 per cent. discount for prompt cash.

With good credit and good paying customers it is profitable for an agent to guarantee payment and thus receive a total commission of 1½ per cent. In the great boom of 1919 and first half of 1920, with yarn prices enormously high, many yarn agents with good connections made very large profits. In 1921-22, many agents and spinners sustained severe losses.

There have been occasions when defaulting customers have caused heavy losses to guaranteeing agents.

Since the total discount from the price received by the spinner selling through an agent may be 3½ or 4 per cent., this per cent. must be added to the cost of production, whereas conditioning of yarn may reduce the cost of production.

If the efforts of spinners to discontinue the 2½ per cent. discount were to materialise, the market prices would speedily be balanced thereto and the costing and accounts correspondingly simplified.

With the very high prices of yarns obtaining in 1919-20 discounts totalled up considerably, since the 2½ per cent. means three times as much on a 7s. 6d. yarn as it does on a 2s. 6d. yarn.

The year 1910 was one example of the very opposite conditions.

In accepting new business through an agent a spinning firm must remember that both written and unwritten laws give that agent power to demand commission from the mill should the firm subsequently commence direct transactions with the customer.

It is a different thing if the agent is a regularly paid employee of the mill—quite apart from the question of commission.

The boom years increased direct dealings, but normally more yarn selling is done indirectly through agents than is done directly between the spinner and the master weaver, master doubler, or other yarn customer.

If a yarn dealer simply agents directly between spinner and user of yarn, he is simply liable for yarn delivered, but if he buys without having sold, or reserves to himself the right to get a higher price for the yarn, he becomes a merchant and is liable for the whole of the contract.

Strengths of Yarn.

Testing of yarns is dealt with in a separate chapter, but a brief reference to strength testing is appropriate here.

Generally speaking warp yarns require to be stronger than weft yarns on account of the warp yarns having to withstand the stress and strains of preliminary winding, warping, and sizing. Also because such yarns must resist the rubbing actions of healds and reed in the loom, as well as the opening and shutting of the loom shedding actions.

Spinners do not usually care to be tied down to a strength test, but some spinners will occasionally take such orders if the price is good enough or orders difficult to obtain. In dealing with such offers a manager salesman is the most competent person because he has the best idea of what his machines, cottons, work-people, and foremen can do.

Strength tables are available and a yarn seller is no worse if he carries tables ready for reference. In spite of the attention given to the testing of single cotton yarns during the last decade or more, the lea test is the one in general use for ordinary commercial purposes.

Any salesman for a particular spinning firm may be expected to know the usual strengths of his more usual yarns.

For example, 30 lb. per lea for moderate 60's Egyptian twist and higher for sakel cotton; 26 lb. per lea for 60's American twist, double roving in each case. For American cotton 32's counts, single roving, twist may pull 50 lb. and weft 40 lb.

The trade twist constants are $3\frac{3}{4}$ for American twist and $3\frac{1}{4}$ for weft. For Egyptian, 3·606 for twist, and 3·183 for weft. In

each case this constant is × the $\sqrt{\text{counts}}$ to get the twist per inch.

In the year 1888 the present writer formulated some brief rules which have been used by many persons in the trade for ready reference, instead of trying to remember longer worked out tables.

These rules were as follow, B.W. representing the breaking weight or strength per lea :—

For pin cops ordinary American cotton $\frac{1,200}{\text{counts}} = \text{B.W.}$

For twist yarns „ „ „ $\frac{1,550}{\text{counts}} = \text{B.W.}$

In each case the above are for single roving. Inferior cotton, badly running machines and bad weather would reduce the B.W., while the opposite conditions would increase the B.W.

For ordinary Egyptian cotton, double roving, we may take as a basis :—

Good combed twist . . . $\frac{2,100}{\text{counts}} = \text{B.W.}$

Carded twist . . . . $\frac{1,800}{\text{counts}} = \text{B.W.}$

Pin cop weft . . . . $\frac{1,450}{\text{counts}} = \text{B.W.}$

Doubling weft . . . $\frac{1,500}{\text{counts}} = \text{B.W.}$

The Egyptian strengths are for double roving.

Sometimes a salesman will take orders for yarn after the market has closed for the day, and he is unable to "fix" his "call" cotton until the day after.

This matters very little in steady markets, but sometimes the next day has opened out with very appreciable variations in price of raw cotton. It is all right for the salesman if cotton has dropped, but all wrong if cotton has risen.

In one recent case within the writer's knowledge, a salesman sold 40,000 lb. of yarn at 5 o'clock, and the next morning the cotton was $\frac{3}{4}$d. dearer, leaving him 40,000 × $\frac{3}{4}$d. worse off than if the yarn had been sold at 2.15.

It is a difficult position for a manager or salesman when sales are fully covered with cotton and then a slump comes and customers refuse to take delivery, and find all kinds of fault with the yarn in order to get concessions in price or to find excuse for cancelling the contract.

The writer has known of spinning firms having to pay interest on undelivered cotton at the same time. The last few months of

1920 developed a good deal of this unpleasant business, and was followed into 1921-22.

Yarn Sales.

Customs in regard to the selling of cotton yarn have been subject to some amount of variation at different times.

Points affected have been mode of selling, amount of discount, time allowed or taken for payment, method of payment, fineness of yarn counts for specific woven cloths, more exact fulfilment of yarn contracts, and variation in length, or number of ends in a warp.

Spinning firms now usually send their own direct representatives to Manchester Exchange, although also ready to do business through independent agents. In former times it was quite common for spinners to send their yarn direct to the agent's office warehouses at Manchester, and to distribute the yarn therefrom.

This is not much done for cotton yarn now, but may be so for much cloth.

Formerly large weights of mule cop yarn from American cotton were packed and exported in casks, and finer yarns in cases, all supplied by the shippers. Spinners now find the cases; casks are now little if any used, best types of cases are returned to the spinner by the home trade, and sometimes from abroad, although poorer constructions of cases for export are not returned, and are largely used.

The manufacturer is now due to pay the spinner in fourteen days, less 2½ per cent. discount. Some pay cash the next market day after delivery, less 3 per cent., the extra ½ per cent. making an appreciable difference in a year's time, and on large transactions.

Formerly credits of cotton yarn were often for one month or six weeks, and remained so for Bradford terms, after ceasing in Lancashire. A full agent's terms have long reached 4 per cent. to the spinner; 2½ per cent. as allowed to weaver, 1 per cent. ordinary commission, ½ per cent. guaranteeing.

Payments.

Payments for cotton yarn were formerly in cash, or directly from person to person on Exchange day, but are now by cheque sent per post, and this greatly facilitates business. Crossed cheques help to make this system safe as well as very convenient.

For many years pre-war, and two or three years afterwards, there was a continual tendency to use finer counts and higher qualities of yarns, cloths, or other goods from cotton yarn. In 1921-22 extreme poverty of trade often led to coarser counts being used to produce cheaper goods.

Counts of Yarn for Cloths.

It has been stated the Burnley printers often used 36's/38's twist and 42's/44's weft in 1910, as against 32's twist and 36's weft in 1890, owing to the tendency towards finer goods.

From 1890 to 1910 many new mills were built for spinning Egyptian fine yarns and double roving American, in the Ashton-under-Lyne, Middleton Junction, Royton and Shaw districts, as well as extra mills in the chief Egyptian spinning centre of Bolton.

Formerly dhooties took 40's twist × 50's weft, but pre-war reached 44's twist and 54's weft, with some tendency to revert coarser again post-war and continued bad trade. Prolonged bad trade in 1922 caused some Blackburn weaving firms to alter their types of cloth.

Some buyers of yarn will be slow to complain if the whole contents of a delivery average the counts within such limits as 31's/33's for 32's, but others profess to be so keen in getting correct counts, that spinners cannot meet them.

31 hanks of 31's yarn weigh 1 lb., the same as 32 hanks of 32's yarn, but will be 840 yards shorter.

61's/62's yarn may be spun in order to deliver 60's from the mill in usual conditioned form. It is more expensive for a spinner to produce 61's/62's yarn than 60's.

The only correct way to adjust many matters fairly between yarn seller and yarn user, is for both sides to adopt a reasonable and fair business attitude.

Counterfoil.

When a contract for yarn is booked by an agent, and a written sale note sent to the spinner, the latter may send a suitably worded and signed contract note for the manufacturer to sign and return the counterfoil, and the use of such counterfoil is strongly urged by many spinners.

A yarn contract note is all the more definite if it specifies clearly the amount and time of delivery.

When styled, "Delivery as required," it may be understood to mean at the average rate previously accepted. For new business such a term should be avoided.

Appreciated Values.

If a spinning firm or an agent over-sells beyond capacity for delivery, and prices then go up, it is possible for the customer to purchase against the spinner from elsewhere, and debit the spinner or agent with the increased difference.

The delivery rate has often been abused by one party or another in regard to Manchester business.

Suspension of business between certain buyers and sellers is probably the more usual method in yarn disagreement cases. Sometimes arbitration; sometimes Chamber of Commerce testings; occasionally the Law Courts.

Depreciation of Values.

In the period 1921-22 it was often extremely difficult for spinners to satisfy purchasers of yarn, and complaints of the most trivial character were often made regarding yarn delivered. Too coarse, too fine, too damp, bad ends, bad cop noses or bad cop bottoms, counts irregular, delivery not quite up to time, thick and thin places in the yarn, discoloration of yarn, cops too long or too short (when for the shuttle), too much or too little twist in the yarn, yarn strength insufficient. Prices kept receding for so long, and cloth business was bad for so long, that if a manufacturer could on any pretext cancel his yarn orders, he could at once buy much more cheaply and get prompt delivery. In one case known to the author a customer took certain low counts of yarn and pressed greatly for delivery when prices were at the top, and then when prices began to recede it was impossible to satisfy him in shape of cop, size of cop, counts of yarn, or moisture. One alleged fault corrected only led to another complaint until the order was cancelled and the user was able to purchase yarn at the lower rates. In another case of a lace manufacturer, he threatened to go into bankruptcy if forced to take delivery of fine yarns contracted for. Many purchasers got off by paying differences on a 20 to 50 per cent. basis of total loss, the losses falling on the shareholders of the spinning concerns.

Great care is needed on the part of cotton spinning firms in accepting through an independent agent new business with fresh customers or manufacturers. It has been held in law that such an agent practically holds a vested interest by which he must receive commission perpetually on yarn transactions between the two parties. Later on the same spinner may sell similar yarns to the same customer through a second agent, and then find he is liable to pay commission to both the new and old agents.

Mixed Orders.

Care needs to be exercised in taking orders for mixed counts and qualities. In pin cop wefts, for example, a large spinning firm may be set out to spin all the range from 70's carded up to 110's combed, and a customer may desire to place an order which

gives him absolute choice. Suppose cotton is bought $\frac{1}{2}$ and $\frac{1}{2}$ to cover such a sale, and the machinery is set out in like manner, it might prove awkward if the customer subsequently required all his order filling in all the higher or all the lower counts.

Again, a salesman may for a time do excedingly well, and find it very easy to sell all his production to only two or three firms; then subsequently find himself in difficulties when these customers for some reason cut him off. To the writer's knowledge this happened in the trade depression of the autumn of 1920 and later.

The world war caused immense loss and difficulty to many of our best spinning firms, who did considerable business with such countries as Germany and Austria. Generally speaking, foreign trade carries more risk to the inexperienced yarn salesman, unless done through well established guaranteeing agents.

When mixed counts or ranges of counts are sold to be delivered as required there may be a sliding scale, $\frac{1}{8}$d. or $\frac{1}{4}$d. per one count in low numbers or two counts in finer yarn. Pre-war variations in price per two counts ran smaller than above, being $\frac{1}{8}$d. per count in condenser yarns, $\frac{1}{8}$d. per two counts in 36's to 50's, 1d. per 10 counts 60's to 70's, $1\frac{1}{2}$d. per lb. 80's to 90's, 3d. per lb. between combed 110's and 120's.

A manager salesman ought to deal more expertly with such mixed requirements than an office salesman.

Mixed Sorts.

Instead of mixed orders running along the lines of variations in counts they may run along the lines of equal counts but for different purposes such as tyre yarns, voile yarns, lace yarns, twist cops, pin cops, bastard cops, doubling wefts, sewing thread yarns.

In any such mixing up of orders the yarn seller must know what his mill can really do conveniently. He must know the twist standards and requirements, and their effect on production and wages.

Usually twist yarns in equal counts are dearer than pin cops or bastards, and a pre-war basis ran somewhat as follows:—

Taking twist cops as a basis, doubling weft might be $\frac{3}{8}$d., bastards $\frac{1}{2}$d., and pin cops $\frac{5}{8}$d. cheaper in each case than the twist per lb., taking counts 30's to 50's. The standard $1\frac{1}{8}$ inch pin cop gauge permits more spindles per mule than the standard $1\frac{3}{8}$ inch twist gauge, and this cheapens production as well as the lower twist per inch for weft.

Bastard cops are frequently spun on pin cop gauge but making the cops as large as possible, often dropping the bolsters on the mule to get longer cops. Such cops run a trifle cheaper than full

twist size, partly because the wages of the operative spinner per 100 lb. of yarn are rather less for the bastards.

Doubling weft is a term often applied to cops of full twist size and spun twist way, but having a lower twist constant. Values in counts vary more greatly in the finer yarns and might be double the above if the range were from 60's to 70's.

Combing again alters relative values greatly. War results and greatly increased cotton and yarn prices, have appreciably altered comparative values and require greater alertness than ever.

Foreign Trade.

Without foreign markets the Lancashire cotton trade would be very much smaller. Unless a spinning firm is a very large one, having very competent men and plenty of reserve capital, it is perhaps best to do foreign business through Manchester agents of standing who can afford to have linguists in their employ. Agents near the business places of the foreign customers take the risk of legal trouble, keep posted with the rates of exchange, and readily calculate the different values of English and foreign monies. At the moment these factors are accentuated by the unsettled conditions resulting directly or indirectly from the war. Cotton goods represent England's greatest export line.

Take Holland or Germany for example: the question of carriage to the East Coast, free on board (F.O.B.), non-returnable packing cases, extended credit, cost of delivery even to the country or town itself, and the question of tariffs, may all be added to the ordinary Manchester terms and conditions.

Motor Transport.

In the case of yarn sold ordinary Manchester terms, all yarns are sold delivered in Manchester, so the spinner is charged with carriage to Manchester, unless otherwise duly specified. Recently there has arisen a vast amount of direct delivery by motor transport from spinning mills in Oldham, Rochdale, Bolton, or other spinning centre, to Blackburn, Darwen, Burnley, or other weaving centre. The release of large motor vehicles from the army, the increased cost of railway transport, and perhaps chief of all, irritating delays in delivery by the railways, have led many spinning concerns to purchase their own motors. Many independent carrying firms in Darwen, Blackburn, and Burnley, now specialise in carrying yarn, skips, and cloth by motor.

In the same way a great deal of cotton (not yarn) is now delivered direct by motor to spinning mills, and especially if unloaded at the docks of the Manchester Ship Canal.

Special Orders.

Of the above character may be considered orders for "mock voile" yarn, ring yarn of carded 23's or 24's counts to pull a specified strength per lea or half lea, yarn spun on long or even on through tubes to enable the cops to withstand the after treatment, and not only extremely costly in the first instance, but unsuitable of tubing appliances and often requiring to be put on the spindles by hand, yarns which require spindle bands turning to get the twist in the specified direction, hard and extra hard twist or crêpe yarns, yarns intended to be dyed in the cop and requiring perforated tubes which will fully withstand the dyeing operations when cop dyeing is resorted to. Mechanical tubers for long tubes are available if required.

In the case of ring mills especially, but sometimes also in mule spinning mills, yarn is sold upon cheeses built up on the quick traverse drum winding frame, or in hanks that have been reeled from cop or bobbin, or even in the form of warper's beams, ready for the slasher sizing frame.

Ball warps produced on the huge circular ball warping machine are sometimes wanted for the coloured weaving trade.

All these operations require additions to the yarn selling prices corresponding with the extra expenses incurred. Pre-war established charges for these special orders have been subject to great alterations, and for prompt market transactions a yarn seller needs to be fully posted up-to-date.

Market Procedure.

On Manchester Exchange it is the daily custom to sell large quantities of yarn by word of mouth only, and a great deal of business is transacted by telephone only. Naturally contracts are made out and sent on when the salesman reaches the mill.

To force a customer by law to stand by his verbal engagements he must have signed a contract, unless he has already accepted delivery or paid something on account. Shabby tricks are uncommon but are not unknown in the trade, especially if the yarn seller is in a weak financial or unknown position, or the customer has a more or less influential connection on the spinning mill directorate, or the customer is a reckless person. Commercial honesty, community of interests, possible loss of future contracts, the matter becoming generally known in the trade, are features which prevail in making verbal arrangements almost as binding as signed and stamped contracts in the cotton trade.

High change may rule from about 2-15 to 3-15.

Notes.

If a salesman "over sells" and is unable to give delivery as agreed upon, it is possible for a customer to buy against the spinner and charge the latter with possible increases in price.

Many a spinning firm has suffered heavily through yarn being sold ahead and not covered with either "spot," C.I.F., or "futures" contracts.

If a spinner in busy times keeps his weekly deliveries inside his production, he is often enabled to take small orders at highly remunerative rates for quick delivery.

A standard order book or contract note agreeing to delivery ought to be made to protect the spinner against failure to deliver owing to break-down or strike which he cannot prevent.

In taking orders regard must be had to the chief holiday times, as these interfere with production on the one hand, or delivery on the other hand.

When yarn prices are declining some customers will try to evade delivery by making complaints of snarls, wrong counts, uneven counts, soft cops, bad cop noses, dampness, etc.

With customers of doubtful financial stability it is best to make small deliveries and obtain payment for same before making further deliveries.

When a doubler on either the ring doubler or twiner doubler system takes bastard cops, he makes more waste therefrom in cop bottoms, etc., than with large cops. With either kind of doubling it is a growing custom to wind several cops on one large cheese or cone before taking to the twisting machine. The winding from cop to cheese or cone may be either single winding or winding two or more ends together.

When a customer for some reason or other wishes to transfer a portion of his order to a very different count or quality, it is for the spinner to decide whether in any one case he shall enforce delivery or shall try to accommodate the customer. Amicable discussion of the question sometimes discloses the best way out. This would scarcely happen in a rising market, as the customer can then usually take delivery and re-sell at a profit.

When a salesman thoroughly understands the ability of his firm to produce different kinds and counts of yarn, he is often able to "follow the market" to the best advantage, and to take orders in those kinds of yarn that he knows will be most profitable.

The yarn forwarding book might be ruled in columns for: date, order no., firm sent to, no. of skips and kind of yarn, gross, fare, net weight.

Empty boxes or skip's book: skip no., date sent out, date returned.

EXAMPLE OF YARN ORDER BOOK.

A. B. C. Co., Burnley

1921.	Order No.	Weight in Cop Yarn.	Counts.	Price.	Terms.	Delivery.
March 4	18	20,000 lb.	28's T.	35d.	Usual Manchester.	5,000 lb., March 8 ,, ,, 15 ,, ,, 22 ,, ,, 29
,, 25	37	4,000 lb.	36's W.	36½d.	2½ per cent. 14 days.	4,000 lb. April 10

Yarn production must naturally be fully considered by the responsible salesman, but he may possibly view the position in a more general way than the manager needs to do.

For example, the manager should have a statement showing the weekly production of each pair of mules, and an equivalent for the ring frames. This spinners' production book may indicate the number of mule, counts, twist or weft, lb. production, and stoppages. This enables the manager to note whether any particular machines reach expected productions, and affords an indication of which machines do well or do badly.

The salesman may be satisfied to know the total weekly production of each kind of yarn, the weight in stock at any time, weights delivered or any special conditions, so that productions, sales, and deliveries shall maintain a satisfactory balance.

Departmental Books for Spinning Mill.

Quite apart from the ordinary office books dealing with financial matters, wages, minutes of director's meetings, letters and similar matters, a reasonably well organised spinning concern will need from twenty to thirty departmental books, more or less needing the observation of the manager and foremen. Some of the mill combines also now develop the obtaining and recording of statistical information to a considerable extent from their different mills.

The more usual departmental books may be comprised somewhat as follows :—

1. Cotton required and cotton bought book.
2. Cotton and bales received book.
3. Cotton bale stock book.
4. Cotton mixing book.
5. Wrapping books for draw-frames and fly-frames.

6. Wrapping of counts and testing for strength books for the mules and ring-frames.

7. A book showing change wheels for counts.

8. Books showing standard particulars for the machines in regard to twist wheels, builder wheels, draft wheels, drag wheels, and speed wheels.

9. When particulars of all change wheels have been standardised by actual practice for particular counts and kinds of yarn with specified counts or hanks of back material, full particulars and statements may be entered up for ready reference and comparison.

10. Complete lists of day wage work-people must be kept.

11. Production books for fly-frames, mules, and ring-frames, may record weekly productions in hanks and lbs., and possibly the basis of payment.

12. It is best to obtain and record weekly the lea or half-lea strength tests of the yarns in process.

13. Books must be kept showing the orders for yarns placed with the firm, dates of promised and of actual delivery of yarns and particulars of yarn skips and boxes sent to and returned from any firm.

14. A stock book for yarn should be kept.

15. The preparation of a weekly sheet such as shown elsewhere in this treatise is of primary importance for the ready reference of manager, salesman, master, or director.

Yarn Transactions.

Yarn agents are the persons who sell yarn produced by spinning mills. They connect the producers with the consumers of yarn. Some agents act for certain firms only; others for any firms on commission. In many cases the salesmen of the spinning firms deal more or less directly with the users of the yarn.

As stated the usual commission allowed by a spinning firm to a yarn agent is 1 per cent. on the invoice amount. In this case the spinner knows who is the purchaser of the yarn, and has to depend on the solvency of the latter for the money.

Partly owing to difficulties that have arisen on this account many agents guarantee payment for the yarn to the spinner, and the latter for this pays the guaranteeing agent a $\frac{1}{2}$ per cent. commission in addition to the usual 1 per cent. given to the non-guaranteeing agent. Yarn agents, commissions are greater per pound weight of material, than are those of a cotton agent or broker.

When the agent thus becomes responsible for payment it does not matter whether the spinner knows who is taking the yarn or not.

In many cases yarn is bought by agents in the cop form, and made up by them into hanks, cheeses, doubled bobbins, etc., to suit certain customers of their own.

The duty of an agent to a spinner is to sell the yarn to the best advantage in every way and to attend to the payment of the accounts.

Other Terms.—The usual Manchester terms are payment in fourteen days, with 2½ per cent. discount. If the yarn is sent to Manchester it is delivered carriage paid, but in other cases it is more generally paid by the buyer of the yarn. As in the case of raw cotton a slight additional discount is made for cash down, this being ½ per cent. for yarn.

A fair amount of cotton yarn is sold in such places as Glasgow, Bradford and Nottingham, and the terms are somewhat different to the Manchester terms.

The discount in Glasgow sometimes reaches a higher rate per cent., with possibly upwards of a month or six weeks' time allowance. Fully as much time allowance is made in Bradford and Nottingham.

It is hardly necessary to add that in Glasgow cotton yarn is largely sold for thread-making, in Bradford for admixture with wool in dress goods, etc., and in Nottingham for lace, hosiery, and for mixing with silk.

One writer says that yarns are sometimes sold to the shipping or export trade on the following terms : " 2½ per cent. discount if payment is made within fourteen days of date of invoice, but the merchant is allowed ninety-five days interest on the amount of same."

Manchester Conference Conditions.

Eighteen years' before the war, competent conferences drew up contract conditions somewhat as reproduced below, and some firms adopted the same, but many other firms did not do so.

1. Actual weight of yarn to be invoiced, including tubes if the yarn be ordered on tubes.

(Tubes weighed in with yarn at 10s. per lb. obviously more for the spinner, than when used for yarn at 1s. 3d. per lb.) During the boom period, 1918-20, new tube prices increased nearly in proportion to yarn prices.

2. When warps or back-beams are sold on the basis of scale weight and the counts are coarse, the seller may not invoice in excess of 1 per cent. over the calculation weight.

When sold by calculation weight any deficiency exceeding 1 per cent. shall be allowed to the buyer.

3. For bundle yarns, a pressed 10 lb. bundle must contain not

less than 9 lb. 14 oz., and a 5 lb. pressed bundle not less than 4 lb. 15 oz. of yarn. (This rule not to apply to long bundles.)

4. The number of hanks in a bundle, taking 840 yards to the hank, must indicate the counts of the yarn. "Sewings" and "Fancy" yarns excepted.

5. In case of dispute as to counts, length, weight, or condition, the yarn shall be tested by, and according to the rules of the Manchester Testing House, and its certificates shall be binding on both parties, who, however, shall have the right to be represented, when the samples to be tested are drawn.

6. Either buyer or seller has the right to ask the Manchester Testing House to repeat the test, and in that case the average result of the tests shall be taken as final, and binding on both parties.

7. The seller has the right to replace rejected yarn if he offers to do so within the original time of delivery, free of all expense to the buyer.

8. If "delivery as required" is specified, or if no time is specified, the contract must be completed within six months, and particulars furnished accordingly.

(Specifications in regard to moisture are not very clear in those conditions.)

9. "Delivery to follow" shall be held to mean at the same rate of delivery as that of the last preceding contract for the same description and quality of yarn.

10. If a contract is entered for delivery at specified dates, the cancelment of any portion shall not affect the remainder of the contract, each portion being deemed a separate contract.

11. Payment of an overdue account shall be a condition precedent to further delivery. Delivery may be suspended by the seller whenever any payment is in arrear for accepted delivery, or for any delivery respecting which formal notice of rejection or claim has not been given by the buyer.

12. In case of a strike, lockout, breakdown, fire, or other unavoidable occurrence, the party affected shall give written notice of his inability to make or accept delivery (as the case may be), and it shall then be at the option of the other side, the aggrieved party, either to agree to the postponement of delivery, or within ten days to give notice to close the contract, and to pay or receive the difference in price, such difference to be fixed by the Tribunal of Arbitration. Contracts for yarn for shipment to foreign countries are excepted from this rule.

13. In default of delivery by the seller at the rate or within the time specified in the contract, of any quantity of yarn bought from him, the buyer may purchase such quantity of similar quality in the open market, charging to the seller the excess (if any)

over the contract price which he may have had to pay in making such purchase. In default of acceptance of delivery by the buyer at the rate or within the time specified in the contract of any quantity of yarn sold to him, the seller may dispose of such quantity in the open market, charging to the buyer the deficiency, if any, as between the contract price and the price realised by such sale. In either case, three clear days' notice in writing shall be given of the intention either to buy or sell, and the quantity of yarn bought or sold shall be deducted from the contract.

14. In case of dispute the decision whether a delivery may or may not be rejected, and what damages shall be paid for breach of contract, shall be left to the Tribunal of Arbitration.

Where yarn is sold under the above rules, the following remark is made at the foot of the contract :—

" Except as may be specified herein, this contract is made under the rules of the Manchester Yarn Contract Conference. All cases of dispute arising under this contract are to be finally decided by the Tribunal of Arbitration recognised by that conference."

The above conference, held in 1896, consisted of representatives of the Manchester, Oldham, and Rochdale Chambers of Commerce, The Federation of Master Cotton Spinners, and The United Cotton Manufacturers' Association.

Immediately post-war boom years saw spinners pressed for delivery, followed by slump years in which manufacturers and doublers grumbled excessively at the yarns. Whatever form of contract obtains, it is always left to reasonableness in dealings, or suspension of business between the buyers and sellers.

Spinners, agents, doublers, and manufacturers, all now subject yarns to more extended and severe testings than was formerly the case.

Cloth Business.

It is safe to say that more export business and more widely varying business is done in cotton cloth than in cotton yarn. Great weights of cotton yarn are used at home in the weaving, hosiery, sewing, doubling, and other trades, the ramifications of the export trade devolving upon those who have the finally produced goods. Gigantic and varying as the English cotton spinning trade may be, it cannot be deemed as complicated or varying in style and make-up as are woven goods. A bare specification of the names and leading features of cotton cloths alone makes a formidable list, such as may be found elsewhere in these pages.

Some of the largest cloth manufacturers, producing huge quantities of specific descriptions of cloth, also carry on large Manchester warehouses and export businesses, with foreign agents. Most

manufacturers of cotton cloth do business directly with Manchester shippers and merchants who transact all the foreign business, negotiate as between manufacturer and customer abroad. The Manchester houses obtain statements as to cloth requirements from the Near East, India, China, or continental centres. The particulars are given to manufacturers, quotations and delivery rates obtained and best quotations cabled abroad. Acceptances, rejections, or best offers may be cabled or written back to England. Cables, telegrams, letters, telephone messages (at home) may pass between the parties concerned—always via the Manchester merchant—until business is done. Some of the Manchester shipping houses do business in a very large way, and often place orders with manufacturers on a speculative basis, the merchants taking profits and losses and taking the speculative risk.

Contracts in the Cotton Trade.

Whatever may be the explanation it is well known that contracts for raw cotton are more rigidly adhered to and are drawn upon more uniform and exact lines, than either contracts for cotton yarn or for cotton cloth. Presumably the powerful Liverpool Cotton Association is chiefly responsible for the strength and perfection of contracts in raw cotton dealings.

Apparently yarn contracts come second in regard to uniformity and explicitness, with cloth contracts varying most.

English cotton cloth manufacturers mostly do business through Manchester shippers or merchants. The merchant may obtain 4 per cent. discount from the manufacturer, but only allow $2\frac{1}{2}$ per cent. to the foreign customer, but sometimes longer credit.

If a merchant buys speculatively from manufacturers, he takes profit or loss independently of the discount.

Neither spinners on the one hand, in regard to yarn contracts and commissions, nor cloth manufacturers on the other hand, in regard to exact form of their contracts with merchants, have been altogether satisfied at times.

Efforts on the part of spinners to follow the cotton merchants in stopping discounts have hitherto failed. Spinners in the boom periods touching 1918, 1919, 1920 were often sadly behind in delivery, and then in the latter part of 1920, in 1921-22 some manufacturers and agents seized on every little pretext to cancel yarn contracts, although the spinner was not allowed to cancel the raw cotton contracts taken up to cover his yarn sales.

There is no form of cotton cloth contract that is generally adopted, and cloth merchants largely adopt their own form of contract and

state their conditions which they seek to get the manufacturer to accept—this being strongly in evidence during the slump of 1921-22.

COMPARISON OF CONTRACT ITEMS (ENGLAND).

Item.	Raw Cotton ("Spot").	Cotton Yarn.	Cotton Cloth.
Specification	Name and kind of cotton.	Twist or weft counts.	No. of pieces, length, width. Twist and weft counts.
Delivery .	Any early day after purchase.	In lb. per week or per month. Or "To follow." Or "As required."	Monthly as specified.
Discount .	None. (Formely 1½ per cent.)	2½ per cent. 14 days. 3 per cent. cash.	4 per cent. cash.
Credit . .	10 days. 5 per cent. per annum, on excess days or for prepayment days.	14 days. Possibly longer for Bradford, Glasgow or Nottingham.	—
Commission	½ per cent. to buying broker.	1 per cent. non-guaranteeing. 1½ per cent. guaranteeing.	Often bought direct from manufacturer by shippers.

Below and above are given tabled forms of conditions which form the basis of cloth specifications, and accredited bodies have endeavoured to bring about stability and uniformity as much as possible, especially in great leading lines of cloths.

Such matters naturally interest Chambers of Commerce in Manchester, Bolton, Blackburn, Oldham, as well as Spinners' and Manufacturers' Associations.

Cloth merchants sometimes insert in their contracts that they will hold manufacturers liable for damage due to the use of chlorides in sizing.

BASIS OF CLOTH CONTRACT.

No. 16.

Cloth Warehouse, M/C.
10*th Sept.*, 1922.

Order given to Messrs. X. Y. Z. by Messrs. A. B. C. & Co., Ltd.

Quantity.	Width.	Length.	Description.	Counts.	Price.	Weight.	Terms.	Delivery.
425 pieces	38 inches.	60 yards.	Sateen E Pick F Reed.	36's T. 50's W.	£ X.	lb. Y.	4 per cent. cash.	Pieces 1923 125 Jan. 100 Feb. 200 Mar.

Notes.—1. The manufacturer must exactly specify his warp requirements, and especially so to a spinner who may possibly be supplying him with beam warps.

2. It is difficult to guarantee absolutely exact width and length of cloth and common sense, custom, and reasonableness need be exercised on these matters. Pulling of cloth by temples one way and by the take-up motion the other way, variations in yarn thickness may affect such matters.

A variation for example of 1 per cent. in length or $\frac{1}{4}$ inch in cloth width might be deemed practically satisfactory.

3. More or less established terms and conditions naturally apply to some markets and some standard cloths, and a contract may just state this or "as before."

Cloth contracts interest cotton spinners from the point of view of the yarns required. A spinner delivering yarn much too coarse or fine may upset a weaver's calculations in regard to the cloth.

Cotton Bill Copied from Mill Books. (*Names altered.*)

When cotton prices were low and before D.D. and discount allowances were stopped.

Liverpool, *October*, 1901.

Messrs. Wm. Williams & Sons,
Pr. P. R. Maldicott & Co.

Bought from X. Y. Z. & Co., Liverpool

Pr. P. R. Maldicott & Co.

Rendered 4/10/1901.
Book No. 13.

D.V.M. 3 bales of Egyptian cotton, ex. Egyptian, 6$\frac{7}{8}$d.

Subject to the articles, bye-laws, and rules of the Liverpool Cotton Brokers' Association, Ltd.

Payment within ten days in cash less 1½ per cent. discount.[1]

Claims for falsely packed, damaged, unmerchantable cotton, will be allowed on the value of the sound cotton at the date of return, if such return be made, and the claim sent in within ten days and three months from the date of the invoice

The articles, rules, and bye-laws of the Liverpool Cotton Association are very numerous and for many years have been printed fully in book form.

Bale No.	Weights.		
	cwt.	qr.	lb.
324	6	2	17
225	6	3	19
326	6	3	24

cwt.	qr.	lb.	
20	2	4	
		6	D.D. (double draft)
20	1	26	
	1	18	bale hoops 27 at 10 hoops = 17 lb.
20	0	8	
		14	lb. tare at 5 lb. per bale.
19	3	22	net.

2,234 lb. at 6 7/8d. per lb.	£63	19	10
Less 1½ per cent.		19	2
	63	0	8
Plus forwarding 2s. 3d. \		8	9
,, brokerage, 6s. 6d. /			
	£63	9	5

Conditioning of Yarns.

Generally speaking the careful and skilful conditioning of cotton yarn improves its working at the immediate succeeding processes. By far the most important of the features is that of strength, and this rises within limits according to the amount of water added, so that 5 to 7 or 8 per cent. of added moisture may increase the strength per lea of 40's to 60's yarn from 1 to 2½ lb. or so. Each one of the properties is more or less related to the others, and the increased flexibility of the yarn due to moisture helps the fibres to bend round each other more easily, and to increase the strength by increasing the "coil" friction of the fibres. The elasticity or stretch of cotton yarns is slightly increased by conditioning partly owing to the shrinkage which takes place when the thread absorbs

[1] D.D. (double draft). Discount, since mostly done away with for Egyptian, stopped 1902 for American cotton. The suspension of double draft—or allowance for scale turning and the discount—certainly simplified the broker's and spinner's accounts.

the moisture, since it is well known that 50's to 60's yarn will become about two counts coarser by average conditioning; the increased flexibility also helps in giving increased elasticity. The term resiliency is not often used in connection with cotton yarns, but since it practically means capacity for springing back or rebounding to the touch, it may be taken to be comprised in the terms flexibility and elasticity.

There are now quite a number of methods more or less in use for conditioning cotton yarn, the tendency of recent years having been towards devices for expediting the process on the one hand, or increasing the conditioning effect on the other hand. For many years the very general method was simply to expose the skips of cops in a conditioning cellar for something like a week, and simply to allow the yarn to absorb moisture in a natural manner; and this practice is still largely in vogue, the cellars being often equipped with humidifiers. Sometimes the yarn is watered with a degging can, and sometimes by special hose pipes fitted with spraying nozzles care being taken to keep the water clean. Dipping the skips, tins, or cages of yarn into a water tank, and winding damp cloths round layers of cops are two of the quickest methods of conditioning yarn. Each firm adopts the method deemed to be most convenient or suited to its requirements.

Damping Cellars.

At times weavers will absolutely pour water upon their cops in order to obtain good effects. The worst of this and similar methods practised by weavers is that sometimes the yarn discolours the cloth. Occasionally weavers will put a damp cloth on their warp when it has been over-sized in order to soften it. A typical damping cellar should be shielded absolutely from the sun's rays, and it is all the better for damping purposes if daylight is almost excluded, although the basements of modern mills do not altogether possess these qualifications. The floor should be of concrete or other substance so as to be impervious to water. Layers of bricks are placed all along the floor, sufficiently apart to allow the skips of cops to rest firmly on the bricks. The skips should be very open, so as to give full opportunity for the moisture getting to the cops. Tins for holding the cops are unsuitable for conditioning purposes. The floor is covered with water to the extent of about 2 inches or so, but not sufficiently deep to touch the bottoms of the skips, as the cops would thus get much discoloured. Water pipes and taps are placed at intervals in the room, and the floor should be of a slight incline, so as to allow the water to drain off. The person in charge of the cellar should be careful to have a proper system

and arrangement of putting the skips of cops into the cellar and taking them out again in proper rotation, so as to allow them all to have the same amount of conditioning as far as practicable. A week might be taken as a fair average time for cops to be under the conditioning process. Sometimes the author has known cops to be forgotten in the cellar until they had gone quite mildewed and rotten. Four or 5 per cent might be regarded as a fair average percentage of moisture to impart by the conditioning process The cops should be weighed upon entering and also upon leaving the cellar. Damping cellars have been largely superceded by quicker methods of recent years.

To Determine Conditioning Effect.

Conditioning of cotton yarn owes its existence primarily to the fact that cotton spins and weaves best in a warm moist atmosphere. Firms that spin and weave their own yarn often condition it, especially the weft.

It has become an established custom to damp the yarn in spinning mills proper, and this adds to the weight of the yarn, as compared to when it comes warm from the spindles. It is often the case that 5 per cent. is added in this manner, and so long as both spinner and weaver, or buyer and seller, are well aware of the conditioning the procedure is quite legitimate. In such cases it is considered in the price, and the buyer gets the benefit of having yarn that is made more workable.

Various methods of ascertaining the amount of moisture in yarn are more or less in vogue. One method is to place a given weight of yarn in a very hot room for a certain time, and to compare the weight before and after such exposure. A method recently come into prominence is to use a special oven, in which a few cops are placed for a short time and heated to chemical dryness. Experiments have demonstrated that yarn should lose a certain percentage under such conditions, and in this way the results of any particular test may be compared to a standard. At times the use of such ovens by manufacturers has led to considerable friction between them and the spinners who have served them. There are many manufacturers who take pains to damp their weft, but do not think it at all necessary to damp their warp yarn.

Yarns for Specific Cloth Effects.

It is pretty generally considered that mule yarn will give a better cover to cloth than ring yarn, and especially with regard to the weft. In some cases it is found that a better cover is put on the cloth by using weft yarn twisted to the left or "weft" way,

while the warp is twisted to the right or twist way. To get a good cover on the cloth it is advisable not to overtwist the weft. It is also considered that a loose, oozy mule yarn is the best possible for taking up a great percentage of size, although many people get all they want out of a ring-spun yarn. For a certain kind of printers it is found that about 30's warp and 38's weft give excellent results with light sizing, mule yarn and weft yarns twisted contrary way to warp yarn. It is possible to vary the cover on the cloth by adjustments at the loom. In another example of "Printers" the standard is 34's warp × 40's weft, with 12 to 15 per cent. sizing for the warp.

Soft Places in Yarns.

The mixing together of long and short fibres of cotton is a cause of soft places in the yarn, or the presence of a large quantity of short fibres will cause it. If the traverse or guide tins or bars, or the top and bottom drawing rollers at any of the machines or the clearers, are allowed to get too dirty, often pieces of the fly will pass in with the rovings, and cause thick, soft places in the yarn. "Wafting" of the tins and creels often causes the same defect. Neglect to clean the flyers on the fly-frames, or careless sweeping and cleaning of such parts, often causes thick, soft places in the yarn. Bad condition of the drawing rollers, or ineffectual weighting or neglect of oiling and cleaning, or wrong setting of the rollers, either at the final process of spinning or at the previous machines, are all causes of soft places in the yarn. Overrunning of the creel bobbins is sometimes a fruitful cause. Hard-twisted and long piecings of the bobbin when creeling will cause the evil. "Thick" and "single" are special defects, which differ from the foregoing in showing up in larger portions. When making changes in the draft wheels and after "sawnies," it is often difficult to keep out defective places in the yarn. In the case of many of the foregoing evils it is at times exceedingly difficult for even good practical men to locate the exact cause of the defect.

The object of conditioning yarn is in the first instance to add to it a certain amount of moisture, in order to impart additional elasticity to the yarn and to prevent it from breaking as often. It also has the effect of making the yarn more solid so as to tend to take out snarls and curling.

Mercerising.

The process of "mercerising" is said to have been originally invented about 1844 and patented about 1850 by John Mercer, a printer or chemist, of Blackburn. John Mercer's patent was for

he purpose of subjecting vegetable fabrics and fibrous materials, such as flax or hemp, to the action of caustic soda or caustic potash, dilute sulphuric acid or chloride of zinc, of a strength and temperature sufficient to produce certain new effects. For various reasons, such as imperfect application and development of the process, cost of the process, shrinkage of materials subjected to the process and improvements in other directions, "mercerising" for very many years received little or no favour or adoption. Quite recently the subject has been taken up again very strongly, snd various patents have been taken for improvements in "mercerising," and it would appear that it has now come to stay. Schreinering and sericising are further developments in detail.

In the process of "mercerising" cotton yarns have imparted to them a durable lustre which makes them look like silk.

Generally speaking the best cotton for "mercerising" is Egyptian, and this process has increased the demand for Egyptian yarns.

The yarns are best combed and somewhat soft twisted and made into two-folds, as in this case the yarn takes the "mercerising" process most readily and perfectly. Sericising is a special form of cotton lustring recently developed by Burgess, Ledward & Co.

Velvets.

There are certain specially good grades of American Orleans cotton, such as Bender's and Peeler's or Mississippi bottom land cottons. These have long been in great favour for velvets on account of their lustre and silkiness, and it is very probable they would be used if reasonably available. No cotton naturally possesses as great lustre as that obtained by mercerising.

Egyptian cotton is also in great demand for such goods as velvets, as it differs little in quality, price and effect produced from the Orleans cottons above specified, although there is often a considerable difference in the colours of the two cottons. Ten-hank roving put up double would be very suitable in either case for 50's to 56's.

Mercerised Yarns.

(*a*) For 2's/80's yarn for mercerising good Egyptian cotton is probably most in demand, and it gives the best results when the cotton is combed and the single yarn is soft twisted with a twist multiplier of possibly 3 taken into the square root of the counts. For an extremely good quality Sea Islands cotton might be used since it is well understood that better the cotton and lower the twist, the more perfectly will the mercerising effect be produced,

and Sea Islands will work with a less amount of twist than any other cotton. There is often considerable strain put upon the yarn in the caustic soda bath, so the quality of the cotton and the amount of twist must be sufficient to withstand this and a little more twist than quoted above may be sometimes necessary unless the cotton and its treatment be very good.

(*b*) As regards the method of doubling it is quite possible to make a two-fold in one operation either on the continuous or intermittent system of doubling, but the more recent practice of using first the doubling winding frame and then the doubling machine, appears to be always increasing in favour. The twisting for the two-fold may be opposite from the single yarn and the twist kept down as low as subsequent strain on the yarn will permit, say the square root of counts doubled × 3 to 4 or so, according to circumstances.

(*c*) After doubling, the yarn may be cleared upon large pear-shaped bobbins which may be taken to the gassing frame, and will last a considerable time while permitting a high speed with end unwinding. Gassing removes the loose fibres and permits greater lustre in the mercerising process. After gassing the yarn may be reeled into hank form, and sent to the mercerising department.

Some Defects in Yarns.

LIVERPOOL

(*a*) Bottom fluted rollers sometimes become damaged, and will then often break adjacent threads, and cause bad ends. It is possible for the flutes to be badly worn, so as to give imperfect drafting, or on the other hand to be so sharp as to tend to cut the yarn, but these defects are comparatively rare. Setting the centres of front and middle rollers too far apart may give uneven drafting, or setting too near may lead to "spewing" of the cotton in raw undrafted portions, especially with lever weighting of top rollers.

(*b*) Channelled top rollers inevitably break the yarn while fluted top rollers give uneven drafting, but both evils are self-evident, and the remedy in each case is obvious. Rough places on the leathers will cause excessive breakage of threads, and also give bad ends, and the rollers should be examined when such evils occur. If the top rollers are dirty, insufficiently lubricated, not set parallel with the bottom ones, or the weights and saddle are not properly applied, the yarn will be thicker and harder, and will break excessively. Examination of the rollers will readily discover the particular cause.

(*c*) Slack spindle bands is a common fault, and leads to soft cops and weak, insufficiently twisted yarn, but a mule or ring-frame worker can easily detect the evil and provide the remedy with a

new band. If the spindles vibrate excessively it tends to weaken the yarn, and the cause is very manifest.

Sometimes tin rollers are out of the true or improperly adjusted, and this will tend to weaken the yarn by giving vibration to the working parts of the frame. Occasionally it happens that a tin roller has become a little loose, and this may manifest itself in softer cops and weaker yarn due to the slippage. Generally speaking, the number of cops thus affected will enable a practical man to trace the cause. Stained yarn is sometimes caused by careless and excessive oiling of top or bottom rollers, and a glance at such yarn indicates the probable cause. If the spindle points vary in thickness some threads will be slacker than others, and careful examination is needed to detect this defect in spindles. A careless piecer may cause oily yarn at the cop bottoms, when oiling the "tops" or bolsters.

Manchester Market.

Yarn Prices, May, 1921.

Such papers as the "Manchester Guardian," "Textile Manufacturer," "Textile Mercury," "Cotton Factory Times," "Bolton Evening News," "Textile Recorder," and "Oldham Chronicle" publish regular statements in regard to yarn sales. The following are examples from one of the best known of these :—

16's weft, American	14d. to 19d.
40's ,, ,,	17 ,, 22
50's ,, ,,	22 ,, 26
60's ,, ,,	28 ,, 31
16's twist ,,	16 ,, 20
32's ,, ,,	18 ,, 24
40's ,, ,,	21 ,, 26
50's ,, ,,	23½ ,, 31
60's ,, ,,	29 ,, 33
32's weft, Egyptian	27 ,, 31½
40's ,, ,,	29 ,, 32½
50's ,, ,,	32 ,, 36½
60's ,, ,,	34 ,, 37½
80's ,, ,,	37 ,, 48½
100's ,, ,,	45 ,, 51½
72's pin-cop. ,,	36½d.
84's ,, ,,	39½

Ring Twist, American.

16 s warp, beam, or bundle	18d. to 22d.
20's ,, ,, ,,	18¼ ,, 22¼
24's ,, ,, ,,	19¾ and up.
26's ,, ,, ,,	20¼ ,,
28's ,, ,, ,,	20¾ ,,
30's ,, ,, ,,	21¼ ,,
32's ,, ,, ,,	21½ ,,
36's ring beams	22 to 26½
38 s ,, ,,	22 ,, 27½
36's ,, ,, double-rove	24 ,, 31

BUMP YARNS.

2's and below	11d. to 15½d.
3's	12½ „ 19½
4's	15 „ 22

LOW COUNT YARNS.

8's to 12's	13¼d. to 15¾d.	Three-fold	14⅜d. to 17¼d.

CARPET YARNS (PREPARATION).

8's to 12's	15½d. to 18½d.
8's/3's to 12's/3's	18½d. Two-fold same price.

TWO-FOLDS.

2's/16's	American ring warp, beam or bundle	24½d. to 26⅜d.
2's/20's	„ „ „	24½ „ 27
2's/24's	„ „ „	25 „ 27½
2's/26's	„ „ „	25½ „ 28
2's/28's	„ „ „	26 „ 28⅓
2's/30's	„ „ „	26¼ „ 28¾
2's/32's	„ „ „	26½ „ 29
2's/40's	„ bundle	28¾

AMERICAN EXTRA HARD YARNS FOR SHIPPING.

4's to 12's	16's	18's	20's	22's	24's
25½d.	26½d.	27d.	27½d.	28d.	28½d.

AMERICAN SHIPPING BUNDLE.

20's XX reel	20d.
24's „	20¼
26's „	20⅝
28's „	21⅛
30's „	21¼

In July, 1922, prices had slumped very much lower than the foregoing.

Cloth Finishing.

It has been estimated that over 7,000,000 yards of cotton cloth are woven in an average year in this country, and that possibly 4,750,000 yards of this cloth go to the cloth finishers for treatment by one or more of the processes of bleaching, mercerising, dyeing, printing, etc., and are subject to the chemical and physical processes included under these headings.

In cases of some specialised goods guarantees are given of certain standards of excellence and freedom from specified blemishes. Finishers are not without faults in their processes, but sometimes their results are adversely affected by positive faults in the woven cloth such as may be traceable to either (*a*) cotton faults, (*b*) chemical faults, or (*c*) mechanical faults.

Dead cotton, black cotton, nep, and unripe or badly coloured

raw cotton affect finishing processes. Badly cleaned cotton, bad ends made at the machine, thick and thin places in yarn, wrongly twisted yarn are spinning mill faults. Uneven weaving, floats, thin places, using mixed sorts of weft, are weaving mill faults. What may be termed chemical faults in woven cloth are more usually due to using undesirable materials in sizing, such as paraffin wax, or zinc and magnesium chlorides.

Requirements of Sales Transactions.

Disputes mostly arise when prices are definitely moving up or down. For example, purchases of yarn or cloth heavily bought ahead at high prices are apt to become troublesome in regard to quality or delivery when prices have materially receded.

It has been stated that a contract of £10 or over is not legally binding by word of mouth only. In addition there must be either a part payment, a part receiving, or the contract or counterfoil has been duly signed.

Managers state their sale of goods contracts are exempt from stamp duty. Contracts for sale of yarn or cloth are often made verbally, but are usually promptly reduced to writing on forms clearly stating essential contract conditions, and best fitted with counterfoils for customer to sign. Private arrangements regarding contracts are not legally binding unless stated in the contract itself. Alterations in time of delivery or other detail by word of mouth, only become legally binding when duly signed in writing.

Instalment contracts are in common use. Ability to cancel by reason of defective or delayed delivery of instalments, or refusal to accept delivery, depends upon the nature of the signed contract conditions in each case. It may be easier to cancel a particular instalment of yarn or cloth than the whole of the contract quantity. An unpaid seller of yarn or cloth may retain possession until payment is tendered, when the material has been sold without credit stipulation, or the credit term has expired, or the purchaser becomes bankrupt. Such seller may not maintain retention rights when the buyer lawfully obtains possession, or the goods have legally been delivered to a carrier or agent duly addressed without reserving right of disposal.

A person may be deemed an unpaid seller if only part of the price has been paid, or when a bill of exchange given in payment has not been duly honoured.

An unpaid seller may often stop goods in transit on learning of the insolvency of a customer, so long as the terms of contract do not prevent this.

Various newspapers and journals give excellent quotations of prices as shown by examples below. For up-to-date information

the reader is referred to such publications as "Textile Mercury," "Textile Recorder," "Textile Manufacturer," and others referred to on page 114.

Manchester Market Prices on a Middle Month in 1921.

CONDENSOR YARNS.

3's to 6's	7's	8's	9's	10's	11's	12's	
13d.	14d.	15d.	16d.	17½d.	18½d.	21½d.	in cop.
16	17	18	19	20½	21½	23½	cone.
14	15	16	17	18½	19½	21½	through tubes.
16½	17½	18½	20	21	22	24	hank.

ELECTRIC CABLE YARNS.

American—

12's/40's	15's/40's	17's/40's	18's 40's	12's/50's	15's/50's
44½d.	44½d.	44½d.	45d.	49d.	49¼d.

17's/50's	18's/50's	12's/60's	15's/60's	17's/60's	18's/60's
49½d.	50d.	53d.	53¼d.	53½d.	54d.

Egyptian—

16's/120's	18's/120's	20's/120's	16's/140's	18's/140's
117½d.	118½d.	119½d.	136½d.	137½d.

20's/140's	16's/160's	18's/160's	20's/160's
138½d.	159d.	150d.	162½d.

MERCERISED COMBED TWO-FOLD EGYPTIAN GASSED.

	2's/40's	2's/50's	2's/60's	2's/70's	2's/80's	2's/100's	2's/120's	2's/140's	2's/160's
Bundle	69¼d.	73¼d.	76½d.	85¼d.	87½d.	102½d.	117½d.	160½d.	208d.
Cone	75½.	81.	85¼.	94½.	98¾.	116.	131¾.	181½.	238.

Sailcloth yarns . . . 25

Belting duck yarn.	Best quality	.	25d.	Common quality	.	20d.
,, cable ,,	,, ,,	.	29	,, ,,	.	27
,, weft ,,	,, ,,	.	24	,, ,,	.	22
,, sewing ,,	,, ,,	.	30			
Tyre yarns (super)	,, ,,	.	71	,, ,,	.	51

COMMISSION WINDING (SINGLE END).

	8's	10's	12's	14's/20's	21's/24's
Cheese or cone . .	3¾d.	3¾d.	3¾d.	4d.	4¼d.

	25's/30's	31's/40's	41's/50's	51's/60's
Cheese or cone . .	4¾d.	4¾d.	5d.	5¼d.

COMMISSION REELING.

	To 20's	21's/30 s	31's/40's
X reel D hank . .	3½d.	4d.	4½d.
7 leas . . .	4¾	5	5½

A sale of yarn is usually made on Exchange verbally, or sometimes by telephone, and with little reference to special terms. Upon reaching his mill the spinner sends to the purchaser a sale note, stating the sale. A counterfoil may be enclosed for the buyer to sign or the buyer asked for a return admission of correct terms.

Neglect of a spinner to obtain due acknowledgment has often led to trouble. A spinner's counterfoil often specifies conditions which the purchaser should carefully note.

A spinning firm wishing to standardise a sound form of contract for yarn sales might be well advised to submit same to a solicitor expert in this line, Mr. Taylor of Manchester being well known in this connection.

Rate and time of delivery need to be definitely stated to avoid trouble.

A buyer may ask a seller to keep back delivery, or give an extension of contract time, and this may be a matter of mutual arrangement.

It has sometimes been the case that claims against alleged defects in yarn have been made *after* such yarn has been put through a bleaching, dyeing, or other finishing process. Spinners are now repudiating such claims.

Vague terms sometimes used are as follows: "As required," "Reasonable delivery," "To follow present orders."

Disputes often follow such indefinite expressions, although between firms of good standing a reasonable give-and-take policy often prevails.

Often on spinner's invoices it is stated that interest will be charged on overdue accounts, but not always so on contracts, although it should be so to be strictly legal.

It has been stated that the Yorkshire form of contract definitely states that payment is due in fourteen days from invoice date, and that 5 per cent. per annum discount will be allowed for prepayment days, or interest for delayed payment at the rate of 1 per cent. above bank rate, but not less than 5 per cent.

Disagreements on yarn and cloth transactions often arise in connection with *delivery* and *payments*.

Yarn Contract Note.

"No. 2.

"14*th August*, 1922.

"To X. Y. Z. & Co. 1920 (Ltd.).

"Dear Sirs,

"We beg to confirm having this day sold to you cotton yarn as specified below:—

Weight.	Counts.		Price per lb.	Terms.	Rate of Delivery-		
					1922.		
	Twist.	Weft.			Sept.	Oct.	Nov.
9,000 lb.		40's mule weft.	15½d.	14 days less 2½ per cent. discount.	3000	3000	3000

"If you make default in any payment for yarn delivered under the contract, we are at liberty to withhold further delivery during such default.

"We are not liable for any complaint made after woven or other manufactured goods are subjected to later processes, such as bleaching, dyeing, and sizing.

"In case of any stoppage of our mill arising from fire, strikes, breakdown, lock-outs, or other cause beyond our control, it is mutually understood and agreed that we suspend delivery during continuance of the stoppage.

"If the contract is entered for delivery at specified times, the cancelling of any portion shall not affect the balance of the contract, each portion being deemed to be a separate contract."

Metric System.

In a review the following remarks were made :—

"A book written as the result of an investigation of the claims made for the metric system, and especially of the claim that its adoption is necessary in the interest of export trade. It establishes an astonishingly powerful case for the retention of our present weights and measures, and an equally powerful refutation of the alleged advantages of the metric system. But the principal theme of the author is that any attempted change from the established English system of weights and measures to the metric system only causes infinitely worse confusion. He tenders evidence to show that this has been the experience of every country which has sought to establish the metric system by legislation, and in nearly all cases he shows that the public prefer to continue in the use of the old standards rather than adopt the metric standards. Even when the legislation authorising the change has been supported by penalties for non-compliance, it has not been sufficient to deter the people from continuing to use the old standards. He very plainly shows that the choice offered to us by the proposed change to the metric

system is not simply that of one of two systems. It is a choice between continuing with our present standards and the confusion which would follow the introduction of the metric system, between which and the English standards there is no convenient comparison, or any sort of easily calculable relation. The difficulty is not merely one of discarding one set of weights in favour of another set : it is that of learning new values for all the commodities we buy and sell and measure ; and this aspect of the question is most lucidly explained."

Road Transport of Cotton, Yarn, and Cloth.

Without doubt the methods and means of road transport in Lancashire have recently undergone a change likely to be permanent and far-reaching, in spite of the recent great amalgamations of railway companies. Railway charges, delays in transit during the years immediately succeeding the armistice, shorter working hours and consequent diminished output of railwaymen and carters have aided in the recent enormous increase in carrying by steam and petrol vehicles by road.

Shorter working hours of horse carters in many cases, and shorter hours in which many goods warehouses are kept open, have compelled the use of heavy motors in order to get certain work done in a day or half-day.

It is thought that railways will adopt improved forms of railway truck, better combination between one railway line and another, quicker collection and delivery of goods at the terminals, and other improvements, but there is no doubt that heavy steam and petrol motor vehicles, as well as lighter motor vehicles, have again brought road transport into great and enduring prominence. Once loading and unloading, direct and prompt conveyance from seller to buyer, or producer to consumer, general improvements in roads offer advantages that cannot be set aside. Even where firms do not own their own vehicles, there are numerous and well-equipped road-carrying firms ready to contract for the work. The present costs and restrictions of terminal working at railways, transference of goods on the route, cannot be ignored. Shorter hours in factories, workshops, and warehouses, often compel direct and prompt delivery. A return journey which would take a horse lorry a day, may be done in two or three hours by a motor. Short distance road business which requires very frequent stopping and starting for collection or delivery may still be favourably done by horse vehicles.

Even higher transport charges are often justified by a distinct saving of time.

On the other hand, organised use of road transport by motor

vehicles instead of by slower horse vehicles will doubtless greatly help to relieve goods congestion at railway terminals and warehouses, more quickly release the railway wagons, and utilise railway labour to better advantage.

Steam, petrol, and electrically impelled vehicles are all advancing in road transport work.

Under ordinary conditions of supply and cost of coal and petrol, it appears that at present the steam wagon is easily the best in Lancashire when it is a question of transporting really heavy loads over considerable distances at the most reasonable cost and freedom from breakdown. For lighter loads and quicker speeds we can see any day in our own roads, that petrol motors are superior to steam. Presumably there will be a touchline on which there will be little difference between the two. Electric road traction for goods may get a better chance at some future time, especially if towns and corporations ever decided to run goods cars through their streets and roads.

Hosiery.

A machine-making firm advertise as below :—

"Hosiery is the youngest branch of the textile industry. It wants exploiting and developing. Knitted products are finding fresh outlets every day, and in one form or another are destined to become a serious rival to many other forms of textile products.

"Up-to-date equipment is the keystone of success. You should have the last word in modern organisation and machinery.

"Whatever line you take or wish to take—

From ties and hatbands to socks and boot linings ;
From combinations and vests to sports coats and scarves ;
From gas mantles and bandages to cardigans and gloves,

you should obtain the latest machinery."

A knitting machine is continuous in production, a loom is intermittent.

Manchester Market Prices on a Certain Month in 1921.

The prices for January, 1923, were totally different from those printed here, but there is considerable educational value in permanently recording one lot of quotations as a basis for study and comparison. Refer to current journals for current prices, the "Textile Murcury" giving weekly lists, such as below :—

AMERICAN SUPER-CARDED.

	32's	40's	50's	60's	64's
Doubling weft	33d.	33½d.	34⅜d.	36⅝d.	37⅞d.
Super-combed	39	39½	40¾	42⅝	43⅝

EGYPTIAN SINGLES.

Carded doubling weft—

						Super.				
50's	60's	64's	70's	74's	80's	90's	92's	100's	110's	120's
41¼d.	41⅞d.	42⅛d.	42½d.	43d.	44½d.	50½d.	52d.	58d.	68d.	78d.

Combed doubling weft super—

50's	60's	64's	70's	74's	80's	90's	92's	100's	110's	120's	140's	160's
50d.	50⅜d.	50⅞d.	51¼d.	51¾d.	53¼d.	55¼d.	55¾d.	56¼d.	58¾d.	61¼d.	75¼d.	106¼d.

Twist (carded and combed) 2d. per lb. extra.

EGYPTIAN TWO-FOLDS.

	2's/40's	2's/50's	2's/60's	2's/70's	2's/80's	2's/90's	2's/100's	2's/120's
Carded	44½d.	48½d.	52½d.	58½d.	63½d.	68d.	73d.	—
Combed	54½d.	58½d.	62½d.	72½d.	77½d.	78½d.	90½d.	95½d.

	2's/130's	2's/140's	2's/150's	2's/160's
Combed only . . .	102d.	111d.	124d.	139d.

2's/90's gassed combed T.O.T. voile 99d. to 113d. on cheese.
2's/100's „ „ „ „ 97d. „ 115d. „

TWO-FOLD GRANDRELLE.

	2's/20's	2's/30's	20's/40's
Black and white	43d.	47⅜d.	51¾d.
Colour and white	43	37½	51¾
Colour and colour	52	56½	60¾

EGYPTIAN THREE-FOLD: 3's/40's 38d. 3's/50's 41d. 3's/60's 44d. 3's/80's 48d.

THREE-FOLD AMERICAN SEWINGS: 3's/26's 27½d./33½d. 3's/30's 29½d./35½d. 3's/40's 30½d./41½d.

EGYPTIAN: 3's/50's 46½d. 3's/60's 52½d.

SIX-CORD CABLED SEWING: 6's/40's 55d. 6's/50's 59d. 6's/60's 64d. 6's/80's 68d. 6's/100's 71d.

HOSIERY YARNS (EGYPTIAN).

	6's/36's	38's	40's	42's	44's	46's	48's	50's	52's	54's
Pin cop. .	28¼d.	28⅜d.	28⅝d.	28⅞d.	29¼d.	29⅝d.	30d.	30⅜d.	30¾d.	30⅛d.
XX reel .	29¼	29⅜	29½	29⅞	30¼	30⅜	31	31⅜	31¾	32⅛

Cheeses or cones 4½d. per lb. extra.

HOSIERY YARNS (AMERICAN).

6's/16's	18's	20's	22's	24's	25's	26's	28's	30's	32's	34's	36's	38's	40's
19½d.	20d.	20½d.	21d.	21½d.	22¼d.	22½d.	23d.	23½d.	24d.	24½d.	25d.	25½d.	26d.

Cones 4d. per lb. extra.

Before now it has happened that a cloth manufacturer has been in the apparently unsatisfactory position of having contracts with cloth merchants on the latter's terms, and for yarn purchases with spinning mills on the spinner's contract forms.

It is clearly his business to note that such contract terms are suitable to himself.

CHAPTER IV.

USES OF COTTON YARNS. YARNS FOR SPECIFIED PURPOSES.

Some Uses of Yarns.

A VERY large amount of yarn of good quality spun from Egyptian cotton, both combed and carded, is made into sewing thread, and such yarns require the maximum strength and uniformity, consistent with the reasonable amount of twist found best in yarns for doubling. For lace purposes, fine two-fold yarns, gassed and probably prepared, are very frequently required, and the doubling weft yarn suitable for this purpose requires the utmost attention in order to get sufficiently good spinning with a small amount of twist. Snarls, bad ends, and uneven yarn are grave faults in such yarns. Warp and weft yarns spun from American cotton are used to a tremendous extent in weaving a great variety of cloths from plain calicoes in narrow looms, up to good twilled sheetings, and many cloths made fancy by colour or special weave. Such yarns are much cheaper than those for lace and sewing thread, and less care is often exercised in their spinning, single roving being deemed good enough at the spinning machine. A large proportion of yarn spun in England is exported to other countries, extra hard twist going to Turkey and Asia Minor for weaving into their special goods, while both moderate and good qualities of yarn are exported to the Continent. Good warps for the Bradford trade, many varieties of doubled yarn and the great variety of uses account for much of the cotton yarn.

Tyre cloths vary somewhat in quality and price, whether intended for bicycles or motor cars, but speaking generally they require very good yarns, although not necessarily very fine. Good tyre cloth may be manufactured from yarns spun from Sea Islands cotton combed. Counts according to amount of doubling. A big line is 23's 12-cord for tyre purposes. A wider range of counts is permissible with hosiery and a wider range of qualities. 20's to 36's yarns from good Indian or ordinary American cotton are often knitted into cheap under pants and cheap stockings, but prices of knitted goods and therefore the qualities of the yarns required may readily be double or even treble the above, and for such, yarns spun

from Egyptian cotton are often used. The term "Balbriggan" is sometimes given to fine underwear knitted from Egyptian cotton yarns. Such yarns are even sometimes mixed with silk for the best underwear, commanding greatly enhanced prices, but not requiring very fine counts. Knitted goods are generally prepared from yarns spun with as little twist as may be convenient in order to retain the quality of softness, whereas yarns for tyre cloths may be harder twisted.

It is very desirable that good healds for weaving purposes should be as strong, smooth, and pliable as can be conveniently attained. Healds are made from different materials, but are very frequently made from doubled cotton yarns; the single yarns, however, need not be very fine, since the finished double thread may be somewhat coarse, and may be varnished to aid in obtaining strength and smoothness. Heald yarn may be doubled either on the ring doubler or the flyer doubler; and in one case it is recommended for 30's/3 or 36's/3 preparing to use a twist multiplier of 5, and for 9-cord finishing, a multiplier of 8; in each case taking this into the square root of the counts doubled.

Features of Cotton Yarn which may affect Yarn Sales.

Yarn for Good Twilled Sheetings.—The yarns used for good twilled sheetings differ very little from those used for good calicoes. Taking really good fine sheetings, we might say about 40's twist and 30's weft, while we might get as low down as 16's weft and 20's twist for heavy ordinary twilled sheetings. It would be necessary for the twist yarns to possess the properties of elasticity and strength in order to resist the strains imposed upon them in the operations of winding, warping and slasher sizing, and in shedding on the loom. To assist in giving the required properties, of course, more twist per inch would be put in than for the weft. The latter not having anything like the same strains to resist, and being required to give the cloth a soft feel and cover, are made with considerably less twist per inch.

Thick Places and Snarls in Yarn.—Taking the snarls first, and supposing that the snarls were found in the yarn upon the cops, some idea of the cause might be formed by a good practical man by making a thorough examination of the cops. First of all, perhaps, it would be best to localise the snarls by finding out whether present in all the cops, and by noting what part of each cop the snarls were most prevalent. If present in all the cops from the same mule the snarls would probably be due to some general cause, such as too much governing or "strapping motion," especially if more prominent before the full thickness of cop had been made, or due to insufficient "snarling motion" or "nosing

motion" being applied if more prominent towards the upper portion of the cops. Or, if present equally all through the cops, due to some such cause as the fallers unlocking too late or not enough "drag." If present in a few cops only, they would be probably due to some such cause as bad rollers or irregular rovings. A very large number of circumstances may cause snarls, and we only indicate here the method of procedure in finding out the cause in any special case, the best thing possible being, of course, for a good practical overlooker to examine the mules themselves.

As regards thick places, their character would very soon enable a practical man to somewhat localise the possible causes. Taking first "thick" roving, this, of course, is mainly caused by the carelessness of the bobbin and fly-frame tenters, as are bad piecings of the rovings, which can be easily localised by their short, hard, twisted and thick character, this being, indeed, so strongly marked that they almost invariably break the threads down.

If the thick places were short, raw portions, we should immediately look for the cause in dirty rollers and clearers and back-roving guides, or noting them to be present in the bobbins the matter would be relegated to the carder, who would probably find it due to dirty flyers on the fly-frames, or to dirty and poor clearers on the drawing-frames.

Again, if the thick places were accompanied closely by thin places, we should soon be examining the rollers of the spinning machine as regards the roller gearing, while, if the thick places were present at more intermittent stages, it would be well to find out whether short and long cottons were being mixed together. Bad piecings at the spinning machine could easily be recognised. Thick places are often caused by overrunning of the mule creel-bobbins. Classes and counts of yarn used for making lace, hosiery, sewing thread, and print cloths.

Cotton yarn for the manufacture of lace is largely cleared and gassed. The clearing apparatus is simply a winding frame, which has for its chief purpose the passing of the thread through small adjustable apertures which will not allow any leaf, dirt, etc., to go forward. In gassing, the thread is drawn rapidly through a gas jet, which burns off all the loose fibre, a burner of the Bunsen type being preferably used. The process also browns the yarn. The counts spun for lace purposes are largely medium fine from Egyptian cotton, this being mostly sent Nottingham way.

Hosiery yarn is of a very different stamp to lace yarn. It is usually soft twisted, the common multiple for twist per inch being square root of counts × 2·75. For the lower counts, say from about 4's to about 20's or so, a mixing containing about four-fifths of Tinnevelly cotton, assisted by a little American to strengthen it, is often used. For the finer counts, say up to about 36's, a much

larger proportion of American or Brazilian cotton may be used. A good deal of this yarn is used up in Nottingham, Leicester, Bolton, and in Yorkshire.

Sewing threads require the best yarns made, Egyptian and Sea Islands cotton being largely used for the purpose. Sewing thread must invariably be of great strength, and this can only be obtained by spinning fine yarns from good cotton and afterwards doubling two or more of the single threads together. For instance, for 12's sewing thread we might have say 50's to four-fold, etc.

Print cloths absorb much more of the American cotton than any other sort. Taking chiefly anything from 20's to 60's, the yarn is used up in the weaving mill for the manufacture of cloth, without anything being done to it after spinning excepting damping and adopting satisfactory means of transit. It is used in the grey without either dyeing, bleaching, doubling, gassing, reeling or any such process, and afterwards the cloth is submitted to whatever processes are necessary to give the required pattern and finish.

General Cloth Classification.

To the spinner wishing to know just a little about the cloths for which his yarns are used, the following brief explanations may be of service, but for more detailed explanations he will refer to treatises on weaving matters, such as "Cotton Cloths" by Walter Hough, one of the Textile Year Books, or other weaving treatises, such as Mr. Watson's two books, or that of C. P. Brooks.

It has been stated that woven fabrics are divisible into four main groups—plain, figured, gauze, and woven pile.

By the term plain weave is generally understood cloths in which every end and pick are woven alternately, with each weft thread at right angles to the warp threads. Stripes and ribs may be formed by using mixtures of fine and coarse yarn, or stripes and checks may be introduced in colours, while maintaining the plain weave.

Figured cloths are very numerous, including such goods as brocades, sateens, damasks, checks, fustians, velveteens, counterpains, and a multitude of fancy cloths.

Pure gauze differs from plain at least in respect of the ends crossing, or weaving at a more acute angle than a right one.

Woven or warp pile cloth has a nap woven across the face and cut whilst in the loom.

The doubling trade consumes a considerable amount of single spun cotton yarn more especially of the better sorts—in the production of such articles as sewing thread, crocheting, belting, tyre yarns, and many other lines, varying from the 1's and 2's cotton waste yarns up to 300's or finer.

The important lace trade consumes a good amount of fine two-folds underwear, and various description of hosiery goods require great weights of cotton yarn of various qualities and quantities, both single and doubled.

The weaving trade probably takes a greater quantity of spun cotton yarn than any other general line, the woven cloths varying from plain weave to the most elaborate Jacquard cloths, having special designations, and requiring yarns varying from the coarsest to the finest that are spun.

Names of Cotton Cloths.

The names of such woven cloths are exceedingly numerous, and many such names are given below, but by no means all.

Alhambra and satin quiltings, apron cloths often of check patterns, angola.

Baffs, bedticks, back and backed cloths, batiste, beauesteen, bandanna, Bedford cords, bazan, brilliantine, brilliant, brocade, brocatelle, Burnley printers.

Calicoes, cabot, cambrics, casements, cashmeres, cellular, Ceylons, canvas, checks, cheese cloth, chinz, coatings, cotton blankets, cotton trouserings, corduroys, cretonne, crimp stripes, Croydon, crèpe de Chine, crash.

Diaper, dimity, domestics, diagonals, deninns, dhooties, drills, drillette, duck, dungaree, dice-checks, damask.

Flannelette, fents, fustians.

Gaberdines, ginghams, gauze or leno, grenadine, grandrelle shirtings.

Honeycombs, Harvard shirtings, huckabeck, hickory stripes.

Italians, imperial sateen, indigo prints.

Jaconettes, jeans, jeanette.

Khaki drills, khangas.

Lappets, lambskins, lawns, lenos, long cloths.

Mexicans, mulls, madappolams, Madras handkerchiefs, Marseilles quilts, matelases, mitcheline, Mysores, moleskins, muslins, moire, moreen.

Nankeen, nainsooks, nurse cloths, native cloths.

Oatmeal, organdie, Oxford shirting, Osna-burg.

Papoons, Pakamas, padded back linings, percaline, piques, Persian prints, pocketings, poplins, pongees, printers, plush velveteen.

Quiltings, may be satin, Alhambra, Marseilles, honeycomb.

Repps, regattas, ribs, robes.

Sarongs, satin, sateen, satinette, satin drill, serge, shirtings, sarries, sheetings, shantung skirtings, sponge cloth, skyleens, swansdown.

Tapestry, T-cloths, toilets, tennis cloth, tanjibs, tartans, towelling, turkey reds, ticks, twills, tussores, tops for umbrellas.

Voiles, Venetians, velvets, velveteens, velour.

Wigans, winceyette, whip-cords.

Zephyrs.

Over 150 woven cotton cloths are named in above list, but the list could be greatly extended. Below are given particulars of some of these cloths, and for a fuller description we must refer readers to cotton weaving treatises, such as previously mentioned.

Some Cloths which use Yarns from Cotton Waste.

Cleaning Cloths.—Lancashire and Yorkshire Textile Mills—especially for spinning—have most of the machinery cleaning done by sponge cloths or wipers which will re-wash several times over. The extraction of the oil helps to pay for the washing, which pre-war was done at the rate of about 2s. 6d. per gross, fetched and delivered, but which at the time of writing has reached more like 4s. or more, and would be still higher only for the good price just now obtained for recovered oil, which is always the property of the washer. The processes of oil recovery, by washing, sieving, tank standing, with or without chemical aids, are of such a nature that it does not pay even a large mill to wash its own cloths. More usually, the cloth washing firms, also spin the yarns and weave the cloth. This matter is dealt with in the author's treatise on "Cotton Waste."

For re-washing, cloths are best of plain weave, with very little difference in counts between warp and weft, and these counts from 65 yds. to 120 yds. per ounce.

Soft Sponge Cloths.—These may have a very thick two-fold weft and the twist may be 15's to 20's or so and operated upon the gauze or leno principle, involving a somewhat costly and complicated addition to the mechanism of the loom. The leno weave gives the requisite firmness and strength to an open fabric. The leno weave is of a light open texture in which warp threads are twisted partly round each other. Specially constructed healds or "doups" are used for the purpose. The principle is often applied to the production of light fancies such as blouses.

Repp.—Sometimes low counts cotton yarns are used in a plain woven fabric, giving 1 thread coarse, 1 thread fine, a coarse pick, the coarse warp ends lifted above the coarse pick so as to produce prominent transverse ribs of a well defined character.

Sheetings.—Condenser weft is largely employed in sheetings as woven in Bolton and elsewhere. Widths may be 70 to well over 100 inches. The condenser yarns may be used either in the grey or bleached state as required.

Woven either plain or twill, the two-and-two twill being in use.

Shirtings.—Condenser yarns are often used in shirtings, the counts being finer than for sheetings. A soft feel is given to the fabric when good condenser weft is used of 6's to 10's counts.

The Oxford shirting may have a ground weave with two ends in a heald, and one pick of coarse weft in a shed.

Quiltings.—There are various styles of quiltings such as patent satin, Marseilles, toilet, alhambra, honeycomb, tapestry.

Bolton is a great centre for quilting weaving—probably the greatest centre in existence—and a great deal of condenser yarn is used as wefts for these quiltings, the counts varying from about $1\frac{1}{4}$ to 10's cotton, quite a lot of the very low count yarn being used in quilts.

Condenser weft is well suited for the warm heavy character required in quiltings, and by using coloured yarns, and the Jacquard shedding motion, large designs and very fancy effects may be readily obtained.

The Patent Satin Quilt originated in Bolton and has obtained a strong hold on the trade—sometimes termed mitcheline.

It contains a smooth raised figure of coarse weft, and a fine warp, upon a smooth, even ground of fine weft and coarse warp, the latter warp being controlled from the Jacquard, and the latter by a four shaft heald arrangement, usually placed at the side of the loom, the four heald staves stretching across the loom in the usual manner. This cloth is an example of two warps, two wefts, Jacquard shedding combined with heald shedding. Wadding weft is introduced into various kinds of more or less fancy cloth in order to produce an embossed or raised effect.

Railway Carriage Cloths, Travelling Rugs. A large amount of condenser cotton yarn finds its way into travelling rugs, which are usually produced from very differently coloured yarns. Yarns of low counts but harsher nature than above may be used in producing cloths for railway carriages, or seatings of chairs.

Table-cloths.—Quite a lot of condenser cotton yarn forms part of many kinds of table-cloth.

Towels appear to absorb more and more of condenser cotton yarn, owing to the absorbent nature of the yarn and the extremely high price of linen yarns. Personal towels need to be softer than pot towels. Both terry and honeycomb towels may use coarse cotton weft.

Flannelettes.—These absorb a large quantity of cotton condenser yarns, the full nature of such yarns giving the warm, soft feeling which makes flannelettes feel full and soft after the style of wool.

Flannelette may almost be described as imitation wool. The wool feeling is enhanced by "raising" the cloth considerably.

Cretonne.—Cretonne cloths may often be distinguished by very

fancy printing effects produced on the cloth. These fancy printings are suitable for hangings and draperies. For the weft low counts yarn of both the condenser and the preparation styles may be used. The fulness of quiltings and flannelettes is not so essential, and the waste weft for cretonne fabrics is often irregular. The weave may be oatmeal, twill plain, or even satin. (See also remarks on cretonnes, page 133.)

Cotton Blankets.—Cotton blankets are used to a large and growing extent, and invariably require condenser weft because of the very full, soft, feel and appearance given to the cloth by such weft. They are woven any width required, and afterwards treated to a generous raising process to bring out the nap as much as possible. They are not subjected to fancy weave effects the same as quiltings, nor to fancy printing effects the same as cretonnes.

Belting.—A good deal of what is termed preparation yarn of 8's or 10's counts is used for the purposes of woven belting, which during recent years has very largely superceded leather belting in many mills. The preparation yarn may be produced on the quadruple coiler system, or by using draw-frames and two passages of fly-frame before reaching the final spinning process. Such yarns suit the hard wearing required from woven belting. At the same time it will take the varnishing and finishing effects very well.

Other Styles of Cloth.

An early writer to give such lists as the present one, was the late C. P. Brooks.

Cords, Moleskins, Corduroy, Fustians, Thicksets, Bull-hides are all pile fabrics of a heavy description. The pile is in the weft floating upon a ground cloth. Moleskin is a smooth, solid cloth of good wearing properties. Some of the above cloths may contain as many as 90 to 140 picks per $\frac{1}{4}$ inch, 20's yarns.

Gauze or *Leno.*—The peculiarity of gauze is that some of the warp ends cross over one or more of the other warp ends, between the picks, giving an open fabric exactly the opposite of the cords and fustians of the last clause.

The gauze cloths may be of a nice, delicate, open nature, and yet possess a fair amount of strength.

The operation of crossing the warp threads may be performed by doup healds. The warp end crossing effect is not confined to fine cloths, as for instance the open weave sponge cleaning cloths. Dhooties, cotton shirtings, and long-cloths are well-known examples of cotton cloths.

Dhooties may be described as shirtings ornamented by stripes of coloured or grey yarn. Used for Indian loin cloths and of suitable length for this effect.

In coloured dhooties, stripes of different colours of warp yarn are woven near the edge of the cloth, the width of stripe varying perhaps from 1 to 4 inches. Sometimes the stripes occur at intervals in the cloth width.

A range of dhooties includes widths varying from 22 to 50 inches. Length of scarf from 2 to 5 yards, the term scarf meaning distance between headings.

A dhootie of 40 yards length, 44 inches wide, containing four double scarves. The dress of a male Hindoo may often be stated to consist of a dhootie 4 square yards, a doputta 8 square yards, and a turban 12 square yards. Sarrie is also of the dhootie character.

Yarns for dhooties and ordinary cotton shirtings may range 36's/60's weft, 30's/40's warp single yarn from American cotton single roving at spinning machine. Lately, it has been stated that many Blackburn manufacturers were contemplating other lines to displace dhooties.

There are shirtings from similar yarns made for export to China, Japan, Turkey, Italy, and other parts. Good shirtings are bleached and exported to Japan, Egypt, India, and China, under the name of white shirtings.

Coloured cotton shirtings of moderate sizing, and yarns 20's to 50's, are much used in stripes and checks for the home trade for any average workmen such as spinners or weavers.

Better class cotton shirtings such as Harvard shirtings have a great vogue in the home market, especially in summer time.

A Harvard shirt may have a 2×2 twill ground weave. About 24's to 30's warp, 16's to 20's soft spun weft, in such colours as red, white, blue, and pink. Oxford shirtings for similar market and wear and colour, originally made with two ends running together woven with a plain ground, 24's/30's warp and 16's to 20's soft weft. Both checks and stripes.

A group of sized cloths, only second to export shirtings, consists of Mexicans, T-cloths, domestics, and madappolams. Not for printing and not much for dyeing.

T-cloths may be shipped from the loom to Singapore, India, Java, Japan, China, South America and North Africa, Rumania, Servia.

May be 24 yards in length, heavily sized, yarn counts coarse—say 20's warp, 16's/20's weft. Name obtained from first exporters using the mark T. American cotton domestics may use 18's/24's warp yarn and weft, varying from 26's/40's. Medium to heavy size. Mostly sent away to such places as Egypt, Turkey, Levant, Italy, South America. Plain woven grey cloths 28 to 39 inches wide.

Mexicans.—Plain woven grey calicoes possibly 32 to 36 inches

wide, 24 yards long, 16's/20's warp, 20's/30's weft bleached. Occasionally coloured and then possibly 2 × 1 twill, for Singapore, Central America, South America.

Madappolams.—Plain woven grey cloth 28 to 36 inches wide, 50's 60's warp and weft. Bleached, and of these finer yarns may be used for underwear. Sent both to the East and to South America.

Other sorts of cloths differing from the foregoing are intended for dyeing and bleaching and possibly printing, may include such cloths as Burnley printers or Burnley lumps, Glossop or Cheshire printers. Printers require to be well-woven cloths from good yarns of medium counts and quality, mostly American cotton, single-roving and often preferred from mule-spun yarn although both mule and ring yarns are in use.

Glossop printers, often from Texas cotton, 34's warp, 36's to 46's weft, mostly plain woven.

Burnley printers may take 32's/50's yarn which is required to be reasonably free from snarls, bad ends, uneven places, thick and single yarns.

Good single roving warp yarn from American cotton, sizing up to about 20 per cent., is a basis for printers.

Some shirtings for export have warp yarns sized up to 100 per cent. on the warp, but such heavy sizing is unsuited for printers.

Ordinarily the business in printers is a large one in Lancashire and uses a large quantity of American cotton, single roving, single yarns.

Amongst *lighter goods* may be classed jaconettes, nainsooks, mulls, cambrics, tanjibs, as very well-known lines.

Jaconettes and nainsooks may be 39 to 44 inches wide, 16 × 16 reed and pick, a standard length of 20 yards, and taking 30's to 50's counts of yarn.

Of a somewhat similar style to above, mulls may be a bit more classy, and may take finer yarns of good quality, 60's to 100's counts ; 20 yard lengths, warps pure sized.

Cambrics may be still finer cloths than mulls, but plain-woven and name supposed to be due to original weaving of these cloths in Cambrai in France. Good quality yarns, often Egyptian cotton about 60's warp and 50's weft.

Exported to Japan, Philippines, India, China, sometimes U.S.A., Turkey, the Levant, Rumania.

Tanjibs may be classed as the coarsest of above group 32's/40's yarn, lightly sized.

A kind of cambric called embroidery cloth is of excellent quality, possibly 50 inches wide, cut up in short lengths. Sometimes exported to Switzerland, embroidered by machinery, and then often reaches England again.

Ginghams, checks, zephyrs may be of plain weave but using coloured yarns.

Sheetings are very wide goods 60 to 100 inches. The yarns are generally coarse 12's to 20's although some sheetings are much finer; may be woven plain or 2 × 2 twill or 2 × 1 twill. Used for bed coverings in most countries.

Cretonnes.—A well-known variety of printing cloth of plain, oatmeal or twill weave. Often cotton waste wefts and wefts 9's to 16's. Warp, finer and in best sorts may be 2's/50's. For upholstering and for use in dress goods especially since the war. Used at home, often shipped to the Near East and to British Colonies.

Distinctive printed effects often produced on cretonne cloths.

Velveteens.—The object desired in this kind of cloth is to obtain a firm ground cloth with picks of pile weft floating over several ends of warp. Pile picks put in between twill and plain ground picks are firmly bound in at intervals, and when the floating portion is slit by the cutter the pile threads will not be loose.

Aprons.—Domestic cloths for home use often using 18's/22's warp and weft, often woven in coloured checks.

Bedford Cords.—Have ribs or cords extending the length of the cloth, warp threads arranged in two sets, may use 26's to 50's weft and half that counts of warp. One use is for dress pieces.

Brocades.—These are fancy cloths in which the warp threads are controlled by a Jacquard machine, and the cloths are mostly of a light character very much differing from some Jacquard productions such as satin quiltings and tapestry cloths.

Systems in Weaving Mills.

Probably the most used system in regard to quantity of material is the ordinary grey yarn system for such goods as Cheshire or Glossop Printers, Burnley lumps, and many other goods. Some weaving concerns specialise in grey goods, others in the great coloured goods trade, while some weave both grey and coloured cloths.

A. The first system such as used for Cheshire and other printers may be specified as follows in regard to warp yarn:—

1. The spun yarn may be conditioned.
2. Winding mostly vertical spindle either from cop or bobbin.
3. Beam warping.
4. Slasher sizing, using large steam heated drying cylinders (air drying is available if required).
5. Either twisting-in or drawing-in.
6. Actual weaving.

B. *Coloured Goods, One Colour Warps:*—

1. Cop, bobbin, or hank winding.

2. Warping on one of different methods : ball-warping by large circular mill, sectional warping, balling, sizing, beaming.

C. *Coloured Striped Warps :—*

1. Cop or bobbin winding.
2. Warping : ball, chain, section, direct ball.
3. Bleaching or dyeing.
4. Sizing.

D. For coloured striped goods the spun yarn is often cross reeled into hanks so as to assume a very convenient form for the next processes of bleaching or dyeing, followed by hank sizing. The drum winding upon warper's bobbins, ball-warping, beaming.

Size of Cotton Industry.

Recently, before the Railway Rates Committee, it was stated there were engaged in the textile industries in this country about 1,250,000 people.

The coal consumption was about 10,000,000 tons annually.

In 1913 over 40 per cent. of the goods manufactured in this country were from the textile industry. Of the total exports in 1920, textiles represented 37 per cent. and in 1913, 28 per cent.

Queensland Cotton.

Twenty years ago the author had samples of cotton sent to him from Queensland, from a former student who had gone to manage a small mill in Queensland. The samples resembled poor American, and the same cotton plants were allowed to produce for at least three years.

After practically dying away, it would appear that cotton growing is now receiving increased attention in Queensland and in certain districts of New South Wales.

It was estimated that the season 1921-22 would produce a crop of 900,000 lb. of seed cotton, some help being rendered by the British Cotton Growers' Association.

It has been claimed that Australia could grow enough cotton for all Lancashire needs. (See previous note on Queensland cotton.)

Spindles and Looms in Lancashire.

An excellent authority has estimated that at the beginning of 1921, there were almost 2,000 firms of cotton spinners and manufacturers in Lancashire and closely adjoining districts.

Almost 58,000,000 spinning spindles—mule and ring—over 2,100,000 doubling spindles, and about 791,000 looms.

In *Oldham* 243 spinning firms containing 17,330,000 spindles—

mule and ring—about 256,000 doubling spindles, ring, flyer and twiners, and over 16,000 looms.

In *Bolton* 109 firms, almost 7,500,000 spinning spindles—mule and ring—183,000 doubling spindles—chiefly ring and flyer with very few twiner spindles, over 23,000 looms.

Rochdale, 114 firms containing almost 3,750,000 spinning spindles—mule and ring—over 113,000 doubling spindles, 17,500 looms.

Manchester, 127 firms, almost 3,500,000 spinning spindles—mule and ring—670,000 doubling spindles, over 23,000 looms.

Stockport, 69 firms, 2½ millions of ring and mule spindles for spinning, about 352,000 doubling spindles, about 11,000 looms.

Burnley has most looms of any town, about 110,000, against Blackburn's almost 95,000 looms.

Burnley, a total of 145 textile firms included in which are above looms, about 545,000 mule and ring spinning spindles and about 1,000 doubling spindles.

In *Blackburn* a total of 140 textile firms, including above looms, about 1,190,000 mule and ring spindles for spinning, and 2,000 doubling spindles.

Exact details are annually published in Worrall's (Oldham) "Lancashire Cotton Spinners' and Manufacturers' Directory," with particulars of each firm in above and all other centres.

From the most recent issue is quoted as follows:—

Spindles and Looms in Lancashire (1922).

"The number of spinning and doubling spindles is given as 59,712,303, against 60,053,246 a year before. With regard to looms, the number is given as 799,000 as compared with 790,399 same time previous year. During the last ten years there had not been much change in the amount of cotton machinery in Lancashire, but in 1906 the figures were 48,322,684 spindles and 648,811 looms. Oldham is given as the biggest spinning centre with 17,168,050 spindles, but compared with a year before there was a decrease of 150,126 spindles. Next comes Bolton with 7,512,731 spindles, an increase since a year before of 57,208 spindles. The Manchester area had 3,505,918 spindles, an increase of 22,686 spindles since a year before. With regard to weaving the largest centre is Burnley, with 110,837 looms, an increase of 897 since year before. Blackburn comes next with 95,391 looms, an increase of 511. There follow Preston and district with 73,866 looms, an increase of 2,230; Nelson and district with 60,746 looms, a decrease of 195 looms; Accrington and district 40,197 looms, an increase of 1,047; and Darwen with 40,014 looms, an increase of 1,304 looms on previous year."

Special Kinds of Yarns.

Cotton Condenser Yarns are produced at the finisher condenser card mostly from cotton waste, ranging from 1's cotton counts from low class wastes for sponge cloths, 2's to 6's for quiltings, up to 10's finer for shirtings, flanelettes, etc.

Preparation Yarns are spun from cotton waste and Indian cotton. Best treated by roller and clearer cards. Mostly 5's to 16's.

Sometimes ordinary cotton machinery, using only one or two draw-frame passages, and only one or two fly-frames.

In the manifold coiler system 4 or 6 cans of sliver are built at one time at the card.

Bourette Yarn is in the class of fancy yarns, and may be spun from short carded silk waste, with nodes of wool or hair at intervals.

Bump Yarn is the term often given to the lowest counts—60 to 130 yards per ounce—of condenser yarns used as wadding weft for toilets, quiltings, some carpets, etc.

Botany Twist Yarns from about 56's botany tops as used for Bradford dress goods or Huddersfield coatings.

Camlet Yarns may be made from wools of good lustre.

Chappe Silk Yarns; made from silk spinners waste and sometimes used in velvet weaving.

Cotton Cord Yarns may be used for such purposes as ornamentation of fabrics having a ground of finer threads. Either single or doubled up to 2, 4 or 6-fold.

Bead, angola, diamond, nepped, cloud, flake, knopped, corkscrew, gimp, grandrelle, snarl, spiral, are all special types of fancy yarns.

Cotton Crêpe Yarns may be of six folds or more for some goods very hard twisted, although some kinds of crêpe yarn are used for both twist and weft in crêpe fabrics, and are extra hard twisted.

Vigogne Yarns may be spun from a mixture of wool and cotton.

Crewel Yarns are more often from good cross-bred wool and used for knitting.

Genappe Yarns are also from wool of good lustre, gassed or singed after doubling to remove loose fibre and give enhanced lustre.

Cotton Heald Yarn is perhaps more often from Egyptian cotton thickly doubled—say 6-9, 12 or 16-fold. Required to be very strong and smooth. Healds may be made also from linen or woollen yarns, or from wire.

Textilose may be spun from strips of paper and low cotton waste and used in bag making.

Lace Yarns are mostly from Egyptian cotton but sometimes from Sea Islands, generally from 80's/2 up to 210's/2-fold gassed.

Knicker or Knickerbocker Yarns contain spotted effects from coloured material mixed up at the carding engine.

Melange Yarn.—A worsted mixture coloured yarn in which colours are printed at intervals on the slivers or "tops."

Merino Yarns spun from cotton and woollen mixtures, possibly two or more parts of cotton to one of wool and used as weft in shirtings.

Grandrelle Yarn is produced by doubling two or three differently coloured single threads together.

Mock Grandrelle may be obtained by printing single yarns or by using double roving in the mule or ring-frame creel, one roving coloured, the other plain.

Ring Yarn.

In many cases there is such close rivalry between the mule and the ring-frame that a comparatively small detail or some side issue will decide whether one or the other will be used in a particular example. There have been cases in which several pairs of mules have been taken out and ring-frames put in place thereof, because there has just been trouble between masters and mule spinners in regard to price lists. In yet other cases ring-frames have been put in instead of mules because the mill was not considered wide enough for modern lengths of mules. These are only typical of very many more or less similar cases.

To deal now with more definite examples, ring-frames are very suitable for mills which produce and sell warp or other well twisted yarns in bundles, warps, cheeses, or other than cop form, there being quite a number of such firms nowadays. *Per contra*, the mule retains its supremacy for the finer counts of yarn generally speaking. It is quite true that a few mills in this country spin up to 100's counts or finer on the ring-frame, from very good Egyptian cotton or Sea Islands cotton, well combed, but the total number of ring spindles thus employed is very small compared with the total number of mule spindles employed on fine counts of yarn in Lancashire. The fact that in the mule we are enabled to utilise the properties of carriage draft, either as gain of carriage or as second stretch or ratching, very greatly helps in maintaining the supremacy of the mule for these finer counts of yarn.

In favour of the mule it is also no mean asset that well-trained mule spinners are more likely to produce good work than the much lower paid ring-frame operatives, and often this is true even if the quality of creel rovings is not quite so good. Again, for pin cop weft to be used in the grey state the mule appears to have retained its superiority for most kinds of looms, and cloth, although not for all. The shuttle space on many looms, and for many sorts of cloth,

is so limited that the cop produced on the bare spindle or very small tube of the mule is preferred to the weft cop produced on the pirn or large paper tube of a ring-frame.

Per contra, the weft replenishing magazines of many Northrop looms appear to be very suitable for the small pirns of weft yarn produced from the weft ring-frame, and in some districts using a somewhat coarse weft in looms, taking rather large weft cops, a preference appears to have grown up for the use of ring-frame weft. A great deal depends upon the kind of cloth required, and it appears to have often been found that ring-frame yarn will generally produce a bare, good wearing cloth, equal in these respects to anything in the same line from the mule, whereas it has been often contended that the average mule yarn will produce a cloth with a better cover and more elasticity than with ring-frame yarn.

CHAPTER V.

OTHER TEXTILE FIBRES. SUBSEQUENT TREATMENT OF COTTON, YARNS, AND CLOTHS.

Textile Fibres other than Cotton.

Below is given a very brief description of the characteristics, uses, and relative values of wool, silk, flax, jute, hemp, and other textile fibres. For more complete information on these fibres, readers are referred to the special text-books of each trade.

The most important textile fibres used for making threads or yarns are cotton, wool, flax, jute, silk, and hemp. Asbestos, and ramie or China grass also have now important uses. Paper yarns were made in Germany during the war and have been made in this country. The paper may be cut into thin strips and then twisted.

Of the above, silk is the most superior, and cotton is by far the most used.

For the most part cotton and silk produce more or less light goods, whereas wool may be used for external clothing in warmer and heavier goods. It is also much used for good, warm under-garments.

Cotton is the most important textile fibre because of its abundance, relative cheapness, its adaptability, and the ease with which it may be spun into yarn, woven into cloth, or doubled to produce such material as sewing cotton. It is the shortest fibre of all, more than 80 per cent. of the total crop being only just over or under an inch in fibre length.

As seen under the *microscope* the cotton fibre appears to be a twisted and collapsed tube; the wool fibre has a scaly surface; flax a straw-like surface with notches similar to those of a bamboo rod; silk shows like a smooth glass rod.

Wool is the natural covering of sheep and goats. For spinning it may be usually anything from about 4 to 10 inches long in the fibre. An average for growth of one year may be 7 or 8 inches long, but if left unclipped, it is possible for wool to grow 30 to 40 inches in length. For example mohair is described as a wool fibre 8 or 10 inches long from the Angora goat.

Animal fibres generally have the distinctive feature of a scaly

surface, with the scales overlapping somewhat after the manner of fish scales. The scaly character of the wool fibre helps to make it so useful for yarn and cloth purposes. The scales interlock and give a strong felting effect and help to produce a compact matted fabric, 2,400 per inch. Various Yorkshire towns are celebrated for the wool and worsted trade; such as Bradford and Leeds.

Silk is so extremely long it may be scarcely said to be spun into yarn, since it is spun by the silk worm in lengths as great as 1,200 yards.

It is the longest, strongest for its diameter and most expensive of all textile fibres. It is the product of the silk worm as a continuous filament reaching possibly 1,200 or so yards in length, with a diameter about $\frac{1}{1400}$ inch. The microscope reveals a two-fold structure in which the two halves are combined more perfectly in the best examples.

Macclesfield is a noted centre for the silk trade.

Artificial silk may be prepared from wood pulp and other materials, and is much used with cotton goods for its lustre. Certain firms do a large business in artificial silk goods. One method uses cotton tinters to make artificial silk.

More usually the body of the cloth may be cotton to give strength and the figuring portion of artificial silk. Cheaper than pure silk, but dearer than cotton.

Flax.—The flax fibre is obtained by special treatment from the flax plant and forms part of the root, stalk, and branches. Linen yarns are spun from this fibre. The flax must be retted before use.

Linen goods are stronger than cotton, will conduct heat better and are therefore cooler to the feel.

The flax fibre is less pliable and less elastic than cotton, but very much longer.

Linen yarns or goods will lose as much as 20 per cent. in bleaching, which is twice as much as cotton. Belfast is a great centre for the production of linen goods.

Jute is largely grown in India. The fibres are thick and long and will snap if hard twisted.

Usually very coarse goods are made from this fibre, such as the tares for cotton bales.

Dundee is a great centre for the production of jute goods. Jute is used for stuffing in carpets.

Hemp is a vegetable fibre grown in Russia, Italy, America, etc.

The best hemp is known as "Manilla." Hemp is much used for twine and rope-making, also for very coarse weaving, although the better kinds are sometimes mixed with flax in finer kinds of cloth.

Carpet weaving, for example, absorbs a good deal of the best

qualities of hemp in the ground fabric. Russian hemp is greatly favoured by many

Mineral fibres are more often of glass, asbestos, or tinsel, the latter being made from copper, aluminium, and other metals drawn out.

Ramie, Rhea, and China grass all belong to the same species (much like the common nettle), and furnish a good fibre for such purposes as gas mantles, but a great difficulty has always been found in separating the fibre from the stem, and in the mill treatment of these fibres.

Grown in East India and other parts of the East, China grass is now used for fancy mattings, partly on account of taking bright colours well in the dye.

Asbestos is much used for engine packings, and in places subject to considerable heat. Also in some kinds of belting.

Treated by roller and clearer cards.

There are firms which card and treat a good deal of asbestos, the roller and clearer card being adopted usually.

It may be used in the making of firemen's jackets. It gives cloth a lumpy, plastic, soft, irregular character.

Comparative Features and Merits of Leading Textile Fibres and Fabrics.

In regard to *niceness of feel*, it may be said that silk goods are mostly very smooth, cotton and silk rather smooth, asbestos greasily smooth, but very weak and can only be spun into very coarse counts of yarn. The term "bast" fibres is applied to flax, ramie, jute and hemp, and they are all rough in the raw state, but after proper treatment they give yarns and fabrics that are reason, ably smooth.

In regard to the important feature of *strength*, cotton and woollen may be classed as moderately strong, silk and worsted as strong, the "bast" fibres as very strong, asbestos as very weak.

Yarns and fabrics from asbestos are non-elastic, cotton and worsted yarns moderately *elastic*, silk and woollen the most elastic.

Worsted yarns are produced from wools by processes somewhat similar in principle to cotton spinning processes, while woollen goods are produced from wool fibres on somewhat different principles, in which felting of fibres is utilised.

Silk and wool goods *retain heat* the best, and cotton goods come next. Flax, ramie, jute, hemp, do not retain heat much, but will conduct the same away, and are not as suitable for giving warmth as in bed-clothes, or in wrapping round hot water bottles.

Generally speaking, materials made from the finest fibres are

usually best able to resist *wear and tear*, because the fibres are more closely twisted together.

Weight for weight silk is the best, followed by flax, cotton, wool, and ramie. Jute is poor.

Silk, cotton, and woollen goods usually are more *flexible* than flax, hemp, and jute.

Silk, worsted, and cotton are best for intensifying and retaining weaving effects in cloth.

To Distinguish Fibres.

There are chiefly five methods for this purpose :—

(1) General examination.
(2) Microscopic ,,
(3) Chemical tests.
(4) Dyeing ,,
(5) Burning ,,

In a general examination it may be remembered that cotton fibres are short, white to brown in colour, soft, not easily wetted, naturally twisted.

Wool fibres are usually distinctly longer than cotton, greasy to the touch, and more firm and springy to the touch.

Silk is practically unlimited in fibre length, white to yellow in colour, very smooth.

Flax in the raw state is stiff, rough, fairly long, and greenish grey to buff in colour.

Perhaps the microscopic test is as good as any for a single test, since it shows up such features as the twist in cotton and the scale in wool.

Burning.—Generally speaking, the vegetable fibres and fabrics, such as cotton, flax, hemp, jute, and ramie, will burn readily in a dry state, while wool and silk will only burn with difficulty with the light in contact, and asbestos will not burn at all. The raising properties of cloth woven from cotton waste condenser yarns enable these cloths to be used for such goods as night-dresses ; but many fatal burning accidents have resulted thereby, which would never have occurred with wool garments. Asbestos is largely used for extremely hot positions, such as linings for lantern boxes, engine packings, and fireproof chambers.

There are methods of treatment by which articles made from cotton or other vegetable fibres may be made at least partially fire-resisting.

Chemical Tests.—Animal fibres are unaffected by acids, but are disintegrated by alkalies ; on the other hand, vegetable fibres are destroyed by acids, but not affected by alkalies. A great deal has

been written in regard to chemical tests for textile fibres and fabrics.

Dyeing Tests.—Dyes and processes are available which only take effect on certain materials; as for example, there are "direct" cotton dyes which only take effect on cotton.

Summary Statement of Textile Fibres.

Textile fibres may be arranged in three divisions as follows: (*a*) Animal fibres; (*b*) Vegetable fibres; (*c*) Mineral fibres.

(*a*) Animal fibres comprise: mohair, cashmere, merino, alpaca, camel hair, silk. Some of these are really special varieties of wool, while silk is perhaps debatably classed either as an animal fibre or a fibre at all, since it is so exceedingly long.

(*b*) Vegetable fibres comprise: cotton, linen, jute, China grass or rhea or ramie, hemp, artificial silk. Paper yarn was produced in quantity during the war.

(*c*) Under the term mineral fibre have been included asbestos, glass, gold, silver.

Chemical Tests for Linen.

Being of a similar chemical composition to cotton, linen is acted upon in a similar manner to cotton by the same chemicals. By treating linen with a sulphuric and iodine solution, the thick cell wall of the fibre is coloured blue, whilst the portion surrounding the central opening assumes a yellow tinge.

Under the influences of the caustic alkaline solutions and other chemical agents, linen is more susceptible than cotton to disintegration.

Tests for Jute.

If jute is treated with a solution of sulphuric acid and iodine, it is coloured dark yellow. It is readily disintegrated and resolved into soluble substances by treatment with acids (especially mineral acids), even at low temperatures.

Tests for China Grass.

China grass is coloured blue by treating it with a solution of sulphuric acid and iodine.

Tests for Wool.

Dilute hydrochloric and sulphuric acids, whether hot or cold, have little effect upon wool beyond slightly separating the scales, and thereby causing the fibres to feel rougher.

If, however, those acids are applied in a concentrated form the fibre is easily disintegrated. Nitric acid acts in a similar manner to those named above, and also imparts a yellow colour to the wool.

Caustic alkalines of soda or potash, even if applied cold and dilute, act upon wool in a destructive manner. If these solutions are applied hot, even in a diluted state, the wool is slowly dissolved and may be precipitated by subsequent addition of an acid.

If boiled in caustic soda lye containing lead oxide, wool becomes black. A boiling solution of plumbite of soda immediately affects wool in a similar manner, and may thus serve to distinguish it from silk and cotton.

Tests for Silk.

Silk is rapidly destroyed by strong mineral acids, but is slightly affected by dilute solutions of those acids; silk dissolves in a concentrated sulphuric acid bath producing a viscous brown liquid. Strong nitric acid also destroys silk, but in a dilute form it has little effect upon the fibre and gives it a yellow colour.

Caustic alkalies if applied in a concentrated form, and cold, quickly dissolves silk. If applied hot the dissolution is more rapid.

Paper Yarn Manufacture (see also page 147).

During the war the Germans and Austrians suffered very greatly from lack of textile raw materials of one sort or another, and made many experiments in the direction of making paper yarns, the efforts continuing after the Armistice. It would appear that a new industry has been established which may possibly greatly develop in the future. Paper yarn in its fundamentals has been in use for centuries. For many years the Chinese used tying up string made from strips of twisted paper.

The principal features of modern paper yarn appear to be somewhat as below stated:—

(*a*) Paper pulp is prepared to form sheets of suitable paper.

(*b*) Cutting up machines are adapted to cut up the sheets of paper into strips of whatever width may be required.

(*c*) Twisting machinery is used to twist these strips into usable yarn, and to wind this yarn into suitable form.

Wet paper yarn making has been chiefly utilised, but efforts are being directed to the manufacture of paper yarn in the dry state.

It has been stated that Germany and Austria only possessed two or three factories for making paper yarn before the war, but during the war these increased to nearly 600 between the two countries, almost as many mills in one country as the other.

Perhaps it is not unfair to assume that many of these mills were small and some of them have ceased to operate since the

Armistice. It is further to be imagined that these countries will be most likely to fu ther develop the manufacture of paper yarn, and that it will be difficult to compete with the fine yarns of the cotton trade.

Artificial Cotton.

There is already a big and valuable market for goods from artificial silk, and there have been some ideas expressed in regard to the possibility of artificial cotton, at present practically unknown.

A very high authority in regard to cotton growing has expressed an opinion as follows :—

"It seemed to him that the suggestion was that if anyone could invent artificial cotton he would just about make his fortune, and he was not so sure the artificial cotton was not going to come. It seemed only in some prospect of this kind, was the ultimate salvation of the cotton trade going to come. Under ordinary conditions the cotton trade could take much more cotton than the average total cotton crop of the world. The question of raw material was by no means fully settled by empire cotton growing, and he was afraid the deficiency would go on until they could discover artificial cotton."

Perhaps it may be inferred that the very high prices of cotton during the boom years 1919-20 would favour the idea of artificial cotton, but the lower prices often prevailing would be against the idea. Kapox fibre resembles cotton but is too soft, short, and weak.

Egyptian Cotton.

It is considered that two important features greatly affect the possible quantity and quality of Egyptian cotton. Almost the greatest question at present is that of drainage. Much has been done in draining the Nile delta, but much more remains to be done, and its efficient completion would materially help in the production of more cotton from this very fine source. Drainage for the time being appears to be almost more important than increased storing and distributing facilities for the Nile waters. Improvements in quantity of Egyptian cotton would also result from successful efforts against the depredations of the pink Boll Weevil.

Wool and Cotton Mixtures.

The war at once caused a tremendous demand for wool and worsted goods, which lasted into the boom years following the Armistice.

One immediate effect was to direct attention to mixtures of

wool and cotton in greatly varying proportions. In one border town the present author often witnessed cotton waste going in good quantity to adjoining woollen mills. On the other hand many cotton mills began to mix moderate quantities of short wool fibre with their cotton, in order to cater for the demand for union goods.

Such tendency was encouraged by the fact that previous to the war, Germany had many spinning and weaving mills, spinning and weaving yarn and cloth from cotton waste and mixtures of cotton with short wool.

It may be taken that the roller and clearer card is fundamentally better for most mixtures of short cotton and short wool.

For such mixtures side drawing at the card, the use of a fancy to lift fibres out of the cylinder, the exceptionally good encasement of the card top, the moderate combing effect of rollers and clearers, and the fewer strippings; are of advantage, as compared with the ordinary flat card. Wool is very short at $1\frac{3}{8}$ inch or $1\frac{1}{2}$ inch length of fibre, but long for cotton fibre, and such wool is perhaps best treated with an opening machine somewhat after the style of a modified roving waste opener instead of a cotton bale-breaker.

Stack mixings permitted any proportions in the blends, and cotton mill blends were often 60 to 70 per cent. cotton, with the rest wool. Agents approached many cotton spinners with offers of short wool, needless to say wool and cotton mixtures require even greater care than cotton mixings in order to produce uniform results.

In an adapted cotton mill, the preliminary opening of the wool would be followed by stack mixing.

Then the ordinary blow-room machinery of hopper bale-opener, hopper feeder. A low-class mixing of cotton and wool might include cotton waste that would be better treated with a willow and a less amount of the ordinary machinery.

Carelessness in making uniform blends, in accurately taking the material from the stacks, and in always keeping to proportions, is absolutely fatal to this business. Writing in 1922, there is not near so much chance for good business along these lines in cotton mills, as existed in 1914-20.

Satisfactory transference of such mixtures from cylinder to doffer at the card often requires reduced doffer speeds. The same with the doffer comb action.

The need for having a superior surface speed of "fancy roller" also requires moderate cylinder speeds. For better sorts of mixtures the revolving flat card already installed was often made to become a paying proposition, but neither for the wool fibre generally, nor for short cotton waste, is the revolving flat card a very suitable machine.

When used for mixtures the flats may be run very slowly, kept

with comparatively dull points by want of grinding and generally made less severe in work done. Only for emergencies and extra good demand along certain lines, does the writer suggest the application of the fancy roller to the flat card, although this has been done many times.

At the draw-frames "mixtures" are usually heavier than the ordinary slivers, and may require more widely set rollers and back or front "tension" drafts adjusted, as well as spoon levers rebalancing. Wider roller settings at bobbin and fly-frames, twist and rack wheel adjustments. One time less round presser for the mixture than for ordinary cotton.

There are many kinds of cotton waste, and low class cottons spoiled with fire, shipwreck, sweepings up from many sources. When these are blended with wool wastes, then colour is difficult to reconcile.

Better mixtures would take card to keep both the fresh cotton and the short wool as near uniform in colour as possible, there being much variety in natural wool colours.

Take a good class of wool and cotton mixture for example, as often used for one class of hosiery or another, and perhaps more often done in a woollen than in a cotton mill. Use a good class of clean, soft cotton with a fair length of fibre, Peruvian being available for this purpose at the time of writing, being momentarily cheaper than $1\frac{1}{8}$ inch Texas and yet reaching $1\frac{1}{4}$ to $1\frac{3}{8}$ inch fibre length. For a good mixture this would help in more readily suiting to short wool, since wool cannot be made to face the rollers of cotton spinning mills unless it is much shorter than the average natural wool.

This length of fibre favours working with revolving flat cards. Probably about 10's/14's yarn counts. Rollers set very wide at all machines. Softly twisted at spinning machines. It is quite possible that really best results would be got by mixing at the first draw-frame in definite proportions.

Attempts at adding colouring powder at openers, scutcher, and cards have resulted disastrously to the wire clothing of the carding engines. Two passages of fly-frames may be sufficient for 10's/14's mixture yarns for hosiery or other purposes.

Paper Yarns.

During the war years, paper yarns and fabrics were made to a considerable extent as a substitute for textiles, especially in Germany.

Under normal conditions, paper yarns are not likely to substitute any of the great textile fibres of cotton, linen, jute, wool, or hemp.

A distinct position, however, has been found for paper yarns

with very glossy finish in certain trimmings, and in such articles as piping for the edges of some upholstered goods. Also for coarse string and for special cordings, and in some cases for clothes lines. Paper yarn is suitable for electric cables in which paper is placed between the leaden sheath and the iron armature.

In making paper yarns one method has been to prepare strips of paper of suitable character and width and twist these on twisting machines. The paper may be cut to convenient counts and not drafted. Very frequently the paper has been considerably damped at the twisting machine to aid the twisting operation, although the moisture is not required in the finished yarn, and special drying methods have been utilised.

More recently strong efforts have been made to twist the paper yarns in a dry state and machines have been arranged for this purpose.

The paper strips are wrought to such a machine in tightly wound rolls as delivered from a slitting machine and modifications in machine are made to suit the material while imparting a uniform twisting effect. Paper yarn made in this way may afterwards be doubled and cabled to produce very strong material suitable for cord for window sashes, clothes lines, and similar purposes. It is claimed that such products are not susceptible to moisture effects.

China Grass.

China grass possesses similar properties to Ramie although the plants differ. China grass is obtained from a plant of the nettle family grown in China and elsewhere. The fibre is strong and of good lustre, capable of producing yarn suitable for weaving into various cloths. China grass is superior to other fibres in resistance to water and is therefore sometimes used for the sail cloths of yachts.

It is used also in the manufacture of incandescent mantles. Effects resembling silk-woven fabrics may be produced with the finest of China grass yarns.

These yarns are sometimes used as a substitute for linen in table cloths and dress goods.

China grass is perennial in growth—unlike other textile plants, and a well-tended plantation will last indefinitely.

The stiffness and brittleness of China grass makes it difficult to draft and twist properly. China grass fibre has before now been mixed with cotton for special effects.

China grass has a certain hairiness which may yet lead to its use more or less as a substitute for wool.

As a rival of hemp it may be used for ropes, nets and cords, and is all the better for being water-resisting.

Great difficulty with China grass has been experienced in separating the fibre from the stalk of the plant, and really successful efforts in this direction would perhaps lead to its more serious rivalry with the leading textile fibres.

Textile Developments, 1922 *Exhibitions in Manchester.*

The big effort which the textile industry of Lancashire and Yorkshire was making to increase its markets was exemplified in two trade exhibitions at Manchester, one for materials, another for machinery.

Twenty years ago the keenest manufacturers had not dreamed of such developments. Piles of goods, apparently rich fur, deep velvet, and gorgeously-toned silk—all made actually of cotton or wool.

The textile industry has surpassed itself in the variety and durability of its products in these exhibitions.

Finisher's Triumph.

"There are spats and leggings, bags, matting, and stair carpet made from wood fibre, and apparently indestructible. This is a determined assault on what war-time exigencies made almost a staple industry in parts of Germany and Austria. Each of these countries has about 300 mills producing these goods. In England there are three, but the British goods, on the word of authorities, surpass the Continental article in pattern, strength, and lasting quality.

"The imitations of fur shown by a number of Bradford houses are the choicest section of the whole exhibition. The resemblance to the natural skin is astonishing, and the sheen, pile, and touch which is produced on this wool and mohair mixture would confound any but an expert.

"It is a triumph of the finisher's art, but all the articles in the exhibition owe their attractiveness to the same charmed touch.

"The desire of all sections of the trade to help each other is shown by the exhibit of the Allied Bleachers, Finishers, and Dyers, which shows common faults in the manufacture of materials which are afterwards passed on to them for treatment. It is realised that only by co-ordination of effort and research can be made articles which will defy world competition, and that is what Lancashire and Yorkshire are out to do."

Profiting by Slack Time.

As an experienced textile manufacturer put it: "Trade has been bad for so long that we have had abundant time to think. When money circulates again, the world's markets will be flooded

with such a range of British textiles, right in price, and so novel in design and quality, that the world will be compelled to buy."

The cotton velours, intended for curtains, upholstery, and general interior decoration, are singularly fascinating. The surface is indistinguishable from velvet, while its soft tone takes the printed design in a way which experts say cannot be equalled by any other material. It is solid enough to stand the wear of a lifetime, and the plain sorts are even being used as uppers for boots.

There are examples of knitted goods from Leicester which look like a loom product, another triumph for the finisher.

It is an important development, for they can be made in this way four or five times as quickly as by the loom. The knitted article, of course, has hardly the same body as the cloth from the mill, but for light women's wear it has its attractions. Lighter qualities, from their airiness and elasticity, are said to come near the ideal for underclothing.

The evidence of sight and touch is quite inadequate to detect that the knitted glove cloth is not yellow suede.

Wool and Worsted.

In worsted spinning four kinds of final spinning machines appear to be used. The mule is distinguished by its versatility of treatment upon different kinds of fibres. The shorter wool fibres may be treated well by the mule in producing hosiery and dress goods, yarns in which fulness and softness are very desirable. The ring-frame is in favour for fine merino qualities of yarns. The cop-frame is used for the finer cross-breds. The flyer spinning-frame is used for hair, lustre, and low cross-bred wool yarns.

Woollen and worsted yarns are dissimilar.

The distinctive feature of the woollen yarn is a crossed and intermingled arrangement of the individual fibres without attempt at parallelisation of fibres.

In producing the worsted thread there is a definite aim at making the fibres parallel as in ordinary cotton spinning, from first entering the gill-boxes to the spun yarn and drawing rollers are used.

The worsted thread by this means becomes more symmetrical than the pure woollen thread, in which there are many projecting portions of fibre. Both yarns are all-wool, but for the purer types of worsted yarns the short, curly and bent fibres may be largely removed in combing; whereas if the wool fibre is designed for woollen yarns, all sorts of fibres are scribbled, condensed, and spun together.

Microscopically, a woollen thread resembles a continuous mesh of entangled fibres, while the worsted yarn appears distinctly more regular, the object having been to use the longest and strongest fibres and to make them parallel.

Cotton Trade Developments.

Cotton has played no mean part in helping on commercial and social developments of recent years. We may, for instance, specify such items as incandescent gas mantles, the outer coverings of bicycle tyres, the coverings of electric lamp wires as examples which have more or less other related connections. Really good Egyptian or Sea Islands cotton, doubled to a sufficient extent, apparently serve best for such purposes as the first two mentioned while cheaper yarns will serve well enough for such purposes as the third one, but much variety is experienced.

Apart from the constant expansion in the uses of cotton yarn upon more or less recognised and established lines, we may mention mercerising as being perhaps the most conspicuous example. This process is said to have been patented by John Mercer about 1850, and after lying almost dormant for many years subsequently developed into a very extensive and valuable business in connection with the cotton trade. In mercerising, a durable lustre is imparted to cotton yarns which makes them closely resemble silk, and enables many beautiful goods to be produced from cotton yarns. In a measure it may be said to have strengthened the position of the cotton fibre in regard to higher priced and more beautiful goods much after the same way that Heilmann's cotton comber did, as invented much about the same time and meeting with much more ready success and acceptance. The resemblance in results attained is even closer since mercerising and combing both very considerably increase the strength of the yarn as well as its beauty. John Mercer discovered that cotton fibres soaked in a solution of caustic soda then became stronger and fuller, with increased powers of receiving colour and making the colours more permanent. After mercerising the brightness and lustre of cotton are improved because of the smoother surface of yarn, reflecting the light much better to the eye somewhat on the same principle that a smooth sheet of water may give reflection. Good Egyptian cotton, soft twisted, made into two folds gives splendid effects in mercerising, and is much used.

Aeroplane and balloon yarns are often made from cotton, and afford very recent and very striking examples of fresh uses.

The "sericising" of Messrs. Burgess, Ledward is a very recent process.

Application of Cotton Yarns.

Some idea of the limits possible may be obtained from what one eminent firm is prepared to do, as below quoted.

This firm is prepared to make 6's to 36's in mule, ring, pin cop, beams, bundles, cheeses, chains, pirns, single yarns or doubled yarns.

Cloth in voiles, zephyrs, Oxfords, Harvards, denims, dungarees, flannelette, ticks, regattas.

Bleaching, dyeing and sizing in warp, chain or bundle, alizarines, mercerising, indigoes.

Will do finishing, raising and packing for the trade.

In carpets will take tapestry and velvet carpets, sofas, rugs and squares.

In canvas: sailcloth, filter ducks, motor ducks, tyre fabrics, packing ducks, belting ducks, shoe ducks.

In hair and cotton belting for driving most kinds of machinery.

A second firm: Braids, chords, laces, smallwares, ribbons, webs, tapes, lamp and candle-wick.

A third firm: Plain and gassed yarns in American, Egyptian or Sea Islands, in cop, bundle, cheese, warp, beam, pirn.

Two or more fold gassed, plain, or prepared.

A fourth firm: Spinners of coloured and grey super condensed, and hosiery yarns.

Dyers and bleachers in the cop, tube, cone, cheese, hank, and beam.

In cloth, fifth firm: White and scoured calicoes, sheetings and sheets, circulars and pillow cottons, pillow and bolster cases, interlinings, frontings, and white shirt cloths, white nurse cloths, white shirtings and Croydons, white and dyed drills, white and dyed ducks, short nap flannelettes, ripple cloth for ladies' dressing gowns, tropical suiting for men's wear, mercerised fancies, artificial silk fancies, aprons, overalls, blouse and skirt cloths, navy blue drills, bluettes for stokers, engineers and railway workers, pocketings, sleeve linings, ducks and calicoes for boot linings and boot tops, etc., bandage cloths, ducks and calicoes for oilskins, waterproof ducks, aeroplane cloths, khaki drills and khaki ducks, cotton tent ducks and sailcloths, ground sheets, filter ducks.

Dyeing of Cottons.

Raw cotton dyeing is practised for the production of mixtures and fancy yarns, such as when different materials, say cotton and wool, are mixed in the fibrous state and spun into threads, or when differently coloured fibres are mixed for flake, slub, and other special yarns. The system is also sometimes used for self-coloured yarns on account of the economy in dyeing due to the smaller amount of handling required. Some of this saving is, however, counterbalanced by the increased cost of spinning operations and the greater weight of material to be dyed for a given quantity of finished yarn. Sliver dyeing is a much better system for self-coloured yarns on account of the greater ease with which opening, carding, and drawing operations can be carried out. The system

also gives a cleaner yarn, for when dyed in the raw state the impurities are not easily removed from the fibres. In both cases the advantages are freedom from shaded or striped pieces, owing to the uniformity of the dyeing, cheaper dyeing, eliminating of reeling and winding compared with hank dyeing, and a considerable saving in waste compared with cop dyeing. Another advantage is the facility with which differently coloured rovings can be drawn and twisted to give imitation or mock grandrelle yarns. Cop dyeing is advantageous when small lots of dyed wefts are required; and also for checked cloths, but it should not be adopted for self-coloured goods, since the dyeing is done in very small batches, and hence the liability to produce shaded or streaky pieces is very great. Although possessing many advantages cone and cheese dyeing are only used to a limited extent for warp yarns, mainly owing to the difficulty of applying the requisite amount of size for weaving purposes. The process of reeling is eliminated, and a considerable saving is effected by winding from the mule cop or ring bobbin, instead of from the dyed hank. But these economies can also be obtained in a ball warp, which can be further dyed at a lower cost and readily sized with each colour in a separate ball. Where the cheese or cone system is adopted warps are made by the section frame and sized by a hot air slasher frame, the colours being specially dyed to prevent bleeding. Back beam dyeing is about the cheapest of all systems of yarn dyeing owing to the weight of yarn handled in one operation. But the dyeing is not uniform owing to the difficulty of obtaining perfect circulation of the liquor through the contents of the beam, notwithstanding that the latter may be wound as soft as possible at the warping frame. The system is, therefore, only to be recommended when slight irregularities in the dyeing are permissible, or when they are minimised by interlacement with the weft, as when the latter is much thicker than the warp, or when they are obliterated by some subsequent process such as raising. For the latter reason the system is applied in the production of the cheaper grades of flannelettes.

Slubbing Dyeing.

Slubbing dyeing is not a new process, but has recently developed. It has been made possible to dye indigo on a practical scale.

Slubbing dyeing presents advantages. In the first place, nothing is dyed except that which is going to become yarn, whereas in dyeing raw cotton all the waste and rubbish is also dyed. In the second place, the dyeing operation is performed with perfect penetration, and for self-colours nothing can equal it for brightness and evenness after the slubbing has been spun into yarn. Machinery required is only simple.

It almost ties a spinner himself to do this kind of dyeing, but it is worth attention. For instance, the spinner may run three or more colours in one yarn and obtain many effects useful in the hosiery trade.

Though indigo has been dyed successfully on a practical scale, the most useful dyes for slubbing dyeing are the sulphur colours and the direct colours.

Coloured and Grandrelle Yarns.

The best established and most used method of obtaining coloured cotton yarns is to cross reel the spun yarn into hanks and dye the yarn in this form. An excellent and uniform effect can be thus obtained, but not only does the grey yarn need reeling and bundling, but after dyeing the hanks need to be reconverted into some form suitable for subsequent processes. It may be thatthe pirn winder, or other modern winder, is used to place the yarn into cop form for use as weft, or on the other hand the yarn may be placed on bobbins for warping.

For these reasons cop dyeing has been adopted to a fairly large extent, especially for wefts, although there are people who consider the dyeing results are not as uniformly equal from this process as from hank dyeing, and the cops often suffer somewhat in the process.

Dyeing the raw cotton is another method possessing its own advantages, although it may be more troublesome to pass such cotton through some of the machines. Dyeing the cotton in the sliver form, or as delivered from one of the fly-frames, is yet another system of making a coloured yarn, and the loose nature of the cotton at this stage should at least conduce to a thorough and uniform penetration of the cotton strands by the dyestuffs. The cop dyeing is most suited for wefts, the hank dyeing for most ordinary purposes, the warp dyeing for warps, or in some places for the glace thread trade as before explained.

Dyeing of slivers or rovings suits the production of some special effects, and dyeing of raw cotton is somewhat of an economical consideration.

Grandrelle yarns are produced from the doubling and twisting together of yarns of different colours, say, for example, of red, white, and blue, or two only of such colours. Used for producing fancy effects in woven goods, for tying up and other special purposes. Differences in coloured yarns, as before explained, will naturally be reproduced in the grandrelle yarns, and need not again be enlarged upon. A cheap grandrelle effect is sometimes produced by a kind of printing process, but such yarns are weaker than the true grandrelle.

Cotton Waste Yarns for Hosiery.

The term hosiery originally applied to leg wear such as stockings, but more generally it now applies to knitted goods, as distinct from woven ones. The knitted goods are usually of much more open texture, and are decidedly more elastic than woven goods, and are made from a wide range of counts and qualities of cotton yarns, as well as to some extent from other textiles. Knitted goods from cotton waste yarns can scarcely range amongst very high qualities of hosiery. One of the chief uses of cotton waste yarns is found in connection with the wefts for cotton blankets, cotton quilts, flannelettes, and many allied fabrics, and these are more usually condenser spun upon the condenser waste spinning mule. Some such yarns may be suitable also for hosiery purposes, but knitted goods have usually to withstand more wear and tear than bed clothing, and so a little stronger, if scarcely so full a yarn may be required.

The preparation system of treating cotton waste is likely to produce a cheap yarn of moderate quality very suitable for some kinds of hosiery goods, since it is usually much stronger than condenser yarn of the same counts.

A good deal of moderate quality knitted material is now used as close fitting wrappering for goods of various kinds for export, and these knitted articles need only be manufactured from cheap and coarse cotton yarns. The best droppings from openers and scutchers, good cardroom sweepings, and clearer waste, all well cleaned, may be devoted to the purposes of coarse waste spinning. Strippings from the cylinder and flats of carding engines, and comber waste are probably the two greatest sources of supply to spinners of cotton waste in decent qualities, these two great classes being very abundant in quantity, and very excellent in quality, and altogether very suitable for covering the range of yarns made from cotton waste. To obtain fulness and softness, and also to permit the designation of "union goods" from one-fifth to one-fourth the total weight of yarn in some knitted goods is composed of woollen or worsted wastes. Many hosiery garments are made from a combination of properly spun cotton yarn, cotton waste yarn, and yarn spun from woollen waste. Sometimes the per cent. of wool is as low as 2 or 3 per cent.

TABLE FOR COTTON AND SPUN SILK YARNS.

Circumference of reel 54 inches, or $1\frac{1}{2}$ yards.

1 thread or 1 revolution of the reel, $1\frac{1}{2}$ yards.
80 threads or 120 yards, make 1 lea or wrap.
560 threads or 840 yards, or 7 leas, make 1 hank.

The counts or number indicates the number of hanks per lb.

TABLE FOR WORSTED YARNS.

Circumference of reel 36 inches, or 1 yard.

1 thread or 1 revolution of the reel, 1 yard.
80 threads or 80 yards, make 1 lea or wrap.
560 threads or 560 yards, or 7 leas, make 1 hank.

The count or number indicates the number of hanks per lb.

Number of yards in 1 lb. of

30's cotton . . . . = 30 × 840 = 25,200
30's spun silk . . . . = 30 × 840 = 25,200
30's worsted . . . . = 30 × 560 = 16,800

Yarns for Specified Purposes.

(*a*) Bleaching fabrics ; (*b*) flannelettes ; (*c*) velveteens ; (*d*) extra weft figured cloths.

In mule spinning the thread is suspended between two fixed points during the time in which the bulk of the twist is inserted. The fibres are thus practically free to adjust their position in the body of the thread, and the result is a yarn that is soft, full, spongy, oozy or fibrous, very elastic and moderately strong. In ring spinning, however, there are only a few inches of the length of thread free from support during twisting, and it is further passed through a traveller during the operation. Hence the thread is practically under pressure and tension during twisting, and the result is a yarn compact in structure with the fibres more completely incorporated with the body of the thread, which is increased in strength thereby. We have to consider a soft, full, and fibrous mule yarn, and a harder spun, smooth, and compact ring yarn. It is clear, therefore, that the former will give a full, dense, and bulky fabric, for apart from its softness the fibrosity helps in filling up the interstices. The latter yarn, however, gives a fabric with an open and smooth appearance, but greater in strength and wear-resisting properties. In England ring weft is very little used, because of the comparative bareness of the cloth surface. It would not be far wide of the truth to say that mule weft would be preferable in each of the four cloths mentioned. For in bleaching cloths the general rule of producing a full dense surface is followed, hence ring weft would only be suitable when a clear, thready surface is wanted. In flannelettes the softness of mule weft would lend itself more readily to the raising process, and give a denser nap. Some flannelette makers, however, use ring weft on account of the superior wearing qualities of the cloth, although the nap is not so good. For velveteens mule weft is the rule on account of the density of the pile obtained ; and the same may be said of the figuring yarn in extra weft cloths because of the better covering properties of mule weft.

For coloured goods the hank and the ball, or chain warp, are the common forms in which warp yarn is purchased, the former when the warps are to be prepared for weaving by the sectional warper, and the latter when they are to be prepared by the methods known as Yorkshire dressing, and long chain beaming. Occasionally warp yarns are purchased, and bleached or dyed in the cop and cheese forms.

For grey goods the bulk of weft yarn is bought in the weft or pin cop ready for placing in the shuttle. It can also be obtained on the ring tube or weft bobbin. The hank is the general form for doubled wefts. Bleached or dyed wefts for coloured goods are purchased in the cop or hank form.

In the end-and-end lease of a ball warp the threads are crossed at one end in such a manner that each can be taken separately, and in its proper order for the use of the drawer-in or twister, while at the opposite end of the warp they are crossed in groups or half beers, one or more of which is placed in each dent of the beamer's reed.

Mercerised Cotton.

See also page 151.

The term mercerising is applied to a process by which cotton yarn or cotton cloth is made silky in appearance, a durable lustre being imparted.

(First noticed by John Mercer of Blackburn, in 1844, and first began to obtain great commercial success about 1895.)

It is not applicable to other textile fibres as fully and well as it is to cotton, and its adoption has greatly increased the value of cotton. Wool resists soda of that strength. Silk does not need it.

Not only is a lustre imparted, but also the yarn or cloth is made stronger by mercerising.

For the most part the process is carried out by treating the yarn or cloth by means of a solution of caustic soda, while under tension, this treatment being followed by washing out of the soda.

Cotton may be mercerised either in the loose state, or in the yarn form, or in the cloth.

Lustre is not much obtained unless the material is under tension, and therefore loose cotton is seldom mercerised, but yarn and cloth are very extensively mercerised.

For the most part cotton yarn is mercerised, either in the form of hank or warp.

Sea Islands cotton and good Egyptian give the best results in mercerising, usually combed and gassed in order to obtain the best effect in lustre and strength. After gassing, yarn is more often doubled before mercerising.

Soft spun or low twisted yarns take the process best.

Process : (1) Treating the yarn or cloth with the caustic soda or alkali.
(2) Washing.
(3) Neutralisation of the alkali.
(4) Keeping the yarn or cloth under tension.
(5) A proper temperature and density of the solution.

Natural wax, oil, or colouring are removed from cotton by this process.

The swelling out effect of the mercerising on the cotton is prevented by tension, and this displaces the fibres and gives lustre.

Mercerised cotton will take many dyestuffs better than otherwise, especially if mercerised without being under tension.

The production and increased use of mercerised cotton is probably the most important development of recent years in the treatment of cotton. It gives cotton the appearance of silk at a much less cost. Sericising is still more recent.

Elasticity is destroyed in yarn or cloth by this process.

Cotton Bleaching.

Cotton in the natural state is readily subject to various kinds of treatment, especially after being well opened and cleaned.

Cotton is dyed at almost any stage from raw cotton to finished yarn, but it is scarcely in a suitable state for dyeing until it has been bleached.

The $\frac{1}{2}$ per cent. or so of cotton wax coated on the fibre makes the fibre insufficiently absorbent to dyeing materials until it has been bleached.

Bleaching also rids cotton yarn or cloth of impurities and dirt which resist dye effects.

Bleaching for "white" is carried out by treating the cotton successively with boiling lime-water, boiling caustic soda, and cold dilute bleaching powder solution, with intermediate treatments by means of cold dilute acid and many washings.

Goods which have to be dyed need not be treated with bleaching powder except in the case of pale and delicate shades.

The earlier operations are always necessary.

Mixture Yarns.

Mixture yarns of one sort or another are occasionally required from cotton spinning mills, and a limited number of such mills now specialise on these lines. War conditions led to a great extension of this kind of work, and such lines are offered by cotton mills as: botany yarns, cotton and wool mixture yarns, coloured yarns of all descriptions, merino union yarns, merino in various percentages in

hosiery twist, weft, and warp twist. The revolving flat card is the standard for ordinary cotton carding; but for cotton and other fibrous wastes, and for other fibres than cotton generally, one form or another of roller and clearer card is usually the best.

Examples of Textile Fibre Uses.

Assuming that fabrics are composed of a single material, cotton would be the best for coloured table cloths on account of its good dyeing qualities, its clear surface, and its smoothness. For white table covers, linen is unapproachable on account of its snowy whiteness. Bed quilts are invariably made from cotton, because of its dyeing qualities for coloured cloths, and its pattern-expressing qualities in the case of white fabrics. Gentlemen's ties are best made from silk, because of its smoothness and lustre. Suitings, for cold and temperate climates, would be made from wool, because of its firmness, strength, and heat retaining qualities. Carpets would be made either from cotton or woollen, according to the quality required, because of their dyeing properties, bulk, strength, and firmness, while terry towels would be made from cotton or linen, because of the absorbent properties possessed by these materials. Coloured table covers and coloured bed quilts are also made from worsted and woollen, ties from cotton and linen, while suitings for hot climates are invariably made from cotton. Gentlemen's ties are often made of linen in poplins, and wear extremely well. Cotton ties are often on the market also.

CHAPTER VI.

COMMERCIAL METHODS. BANKING PROCEDURE. TEXTILE COMPANIES. TRADE UNIONS.

Transport Expressions.[1]

F.O.B., or "free on board," is a very favourite expression for English made goods, and means that the producer, home agent, or other seller, for the inclusive price quoted for the goods will deliver them free on board ship, himself paying for local costs from works to railway, railway charges, and also cost of loading on the ship.

C.F. means "costs and freight," or all costs excepting insurance to the port of destination of the vessel.

C.I.F. or "costs, freight, and insurance," means C.F. plus insurance. C.I.F. is a favourite method for buying raw cotton for use in this country.

Franco is just about the fullest expression for delivery of goods, and means all that is meant by "Loco," F.O.B., and C.I.F. Franco means that the seller will deliver the goods at the price quoted, free at the foreign town, inland or otherwise, or practically at the door of the user. The seller supplies the goods, pays all transit charges, road or rail, to the ship's side, places the goods F.O.B., pays freight and insurance, pays foreign import duties, and finally pays carriage to the user's place of business.

The simplest and cheapest procedure for producers of cotton machinery, cotton yarn, or cotton cloth would be to state in the contract price the formula "delivered at our works." This is a formula sometimes adopted by machine makers but not for yarn. "Loco" is the next simple expression meaning delivery at the local railway.

Demurrage means a storage charge of so much per day made by holders of goods on behalf of persons or firms who have failed to remove same.

The railways may charge demurrage to a spinning firm for storing or holding cotton bales at the goods station beyond a speci-

[1] The commercial and business explanations given in this chapter, represent only the more common features: book-keeping works and commercial classes, are required for fuller study.

fied time, but are not supposed to charge for Sundays or legal holidays.

Firm Offer.—A term sometimes used by business men, and may mean on the part of a spinning firm, they have made definite or "firm" offer at a certain price, within a specified time, of certain yarns. Being a "firm" offer they will not offer or sell the same goods to anyone else until the time limit expires, or the goods are definitely refused.

Freight is the term applied to charges for taking goods across the water.

Forwarding, in relation to cotton at Liverpool, means transferring cotton from Liverpool warehouse to Liverpool railway for inland transit; but does not include railway charges.

Steam Wagons.

For road transport in connection with cotton spinning mills, horse conveyances are now little used except for coal carrying or conveying goods to and from mill and station; often not for this work.

The race for supremacy lies more between the modern steam wagon and the motor lorries for longer distances. The motor rather favours quick handling and speed, while the writer has been informed by several mill managers that the steam-wagon is much cheaper to operate, and very free from accident, capable of carrying any loads permitted by the roads, and readily fitted with tip-up unloading devices. Both motor and steam wagons are easy to control.

The firing control and stoking required for the steam wagon is a feature which does not commend itself to every driver, but the coal cost per mile is very low.

Whether motor or steam wagon be used, careful attention to lubrication, valves, axles, tyres, and all gearing or levers, will most assuredly pay for itself.

A *Factor* may be an agent dealing in his own name, but entrusted with the disposal and control of cotton, cloth, yarn, or other goods belonging to other individuals or other firms.

Assets is a term meaning the total funds, goods, and property of every kind belonging to an individual or a company, and which may be liable for the payment of debts. It includes debts owing by others to the firm or person. More technically, assets may be defined as the debit balances of the ledger accounts.

An *Assignment* means a legal transfer of property, goods, interest or right, from one firm or person to another who is termed the "Assignee." An agent owing money for yarn could become an "Assignor" by executing a deed for the benefit of a spinning firm to enable them to realise his estate, or there might be a duly stamped

and registered "*Deed of Arrangement*" between a debtor and his creditors in order for them to get the most they could, without the debtor being forced into bankruptcy.

Rise of Cotton Industry.

The great importance of the cotton trade to Lancashire dates back to about 1700 or earlier, at which date cotton was beginning to assume more importance than woollen or linen manufacture in the Lancashire textile districts, having Manchester as a centre and as a central market from the very first. In less than a century cotton became and has ever since remained the supreme industry in these localities, remembering that bleaching, dyeing, calico printing, textile machine making, many lesser industries, and even steam engine building, have formed part of the grand cotton scheme, as well as spinning and weaving.

For many years hand-wheel spinning with hand-loom weaving; then jennies, hand-mules, self-actor mules, continuous spinning frames, allied processes, and power-loom weaving, mechanical and productive developments taking place rapidly from about 1760 to 1840; since which latter date mechanical development has always been progressive, but seldom upon great or rapid lines.

Convenience to Liverpool as a raw cotton centre, previous textile training of workpeople in woollen and linen, natural suitability of climate, and more recently, the Manchester Ship Canal, have all helped progress in the cotton districts of Lancashire and near portions of the adjoining counties of Yorkshire, Cheshire, and Derbyshire. Inside the limited period, 1760 to 1780, there were the fundamental inventions of Kay's flyshuttle, Hargreave's Jenny, Arkwright's spinning frame, Crompton's spinning mule, and other inventions.

Partnerships.

1. The sole trader assumes all the responsibility of profit and loss and working of the concern, and employs operatives and persons in charge according to size of his business and personal ideas. The sole trader is now seldom found in spinning concerns in England partly because of their great size; but is much more often found in the smaller weaving or allied concerns. He is responsible to creditors to the full extent of his private property in the event of bankruptcy.

2. A partnership has much the same legal and business footing as a sole trader, with the difference that possible profits and losses may be individually proportioned to amount of capital each partner subscribes to the total. Any partner taking active management

control would receive proportionate payment for such services apart from question of profit or loss on the working of the concern.

3. A Private Limited Company forms a distinct advance upon ordinary partnership inasmuch as certain procedure must be adopted in articles of association, meetings must be held and information afforded, although financial responsibility may be limited. War-time legislation compelled the names of persons comprising a Private Limited Company to be printed, so that they could become known to people doing business with such firms.

4. The Limited Liability Company represents the highest ideal hitherto obtained for spinning companies, in which either large, medium, or small amounts may be subscribed either as loan money or share capital, and a person's financial responsibility in the case of bankruptcy is limited to the amount of his share capital. There have been many cases in which the actual subscribed capital has been exceedingly small in proportion to the amount of loan, and although the shareholders are by law liable for the full amount of their uncalled-up subscription in case of bankruptcy, yet some such shareholders have made themselves liable for more shares than they could pay for if a crises came. War-time legislation tended to reduce the possible magnitude of this anomaly.

In cotton spinning a "sole trader" is mostly too limited financially or is unwilling to assume the full risk of a large concern. He is yet often found in weaving.

Partnership solves these difficulties in some cases, bringing in fresh capital, reduced responsibility, and perhaps greater ability; but these two methods serve better and are more in force for the smaller weaving mills than for spinning mills.

Private Limited Companies still more widen the scope along the same lines, but Joint-stock or Limited Liability Companies now almost dominate the spinning industry, ranging from very large associations and combines of mills, combines of four or five firms, down to scores of mills, each forming a separate company.

Even the largest financiers in the cotton trade find it more profitable to become shareholders and loan-holders in Limited Liability Companies than to become sole traders. By contributing a more or less substantial proportion of loan or share capital to several individual firms at flotation or other critical times a financier often secures substantial concessions connected with dealings in cotton, coal, waste, belting, oil, machinery, or in other ways aside from the questions of dividend and interest on money lent.

It has happened in some cases that operative spinners have only been appointed to pairs of mules in new spinning firms on condition of putting in a specified amount of loan or share capital, and this is perhaps rather a bad thing in that invested money has counted instead of efficiency.

Apart from this point it may be conducive to maximum quantity and quality of work when almost every workman is a substantial shareholder, although this idea breaks down when workpeople prize an easy position more than a limited amount of invested capital—a thing which has often happened in co-operative societies.

Soundly financed, completely managed, so arranged that buyers and sellers of any commodity dealing with a firm, must depend entirely upon really free, open competition, neither director, financier nor workman exercising any adverse grip or influence on a firm; then the joint-stock or limited liability movement has proved to be a good thing for the English cotton spinning industry.

"Cartels" Agreements in the Cotton Trade.

"Cartels" or agreements in the cotton trade as between employers and employees are as fully developed and as closely adhered to as in any branch of industry in the world, especially in regard to spinning and weaving. Lists of prices, payments and allowances to meet special working conditions, have been in operation for very many years; they have been repeatedly amended to meet modern conditions and unexpected circumstances, and have been subjected to scrutiny and consideration by many of the most expert men on both sides, until cartels or agreements have been reached on almost every point.

In the Bolton Province there has only been one local dispute in twenty-five years in the spinning mills, that has led to a mill being on strike or locked out; all other disputes having been adjusted by mutual agreement. This remark does not apply to stoppages for bad trade, or to amalgamation disagreements affecting the whole of the cotton districts.

Not only are spinners, cardroom workers, or weavers combined into many more or less local Trade Union Associations, but in each case there are large amalgamations, which have again often acted in concert with each other.

On the other hand there are corresponding local and general associations and federations of employers in the cotton trade. It is seldom that strikes or lock-outs occur without repeated meetings and conferences of the respective associations.

"Prime" Costs and "On" Costs.

The "prime" cost of material is comparatively high in the case of cotton spinning mills whereas the "prime" cost of wages and labour are usually comparatively small.

Neither are the overhead expenses or "on" costs very high.

Pre-war there were periods in which 1 lb. of raw American

cotton cost about 5d. per lb. and the finished 24's to 28's yarn was sold at about 7¾d. per lb., Manchester terms, so that 2¾d. covered all the "prime" costs of labour and all the "on" costs as well.

With 5d. as "prime" cost of material, and 7¾d. as "final" or sale cost of yarn, it cannot be said that "factory costs" in the mills, "commercial costs" in the way of commissions, travelling and book-keeping, nor proportionate management expenses, were high in relation to "prime" cost of material.

This included depreciation charges on mills and machinery.

These figures are only quoted as a basis, since the war completely upset all ideas and standards in regard to "costing."

(Palmers' "Shareholders' and Directors' Legal Companion," Gore Brown's "Handbook on Joint Stock Companies' Law," and any good Elementary Commercial Book-keeping, Wages lists of Operatives' Associations, Textile Year Books, Hardman's "Cost of Production," etc., are among the works required for a good knowledge of Cotton Economics.)

Finer counts of yarn and combing add greatly to the "factory cost" per lb. of yarn.

Bank Charges.

Bank charges comprise interest on overdrafts, commission on drafts and cheques, postages, charges for cheque books; also charges for collecting debts abroad if any.

All banks charge interest on overdrawn accounts, and it may happen that some of them allow interest on the minimum balance of the current accounts of customers.

Bank commission for cashing cheques drawn by customers varies usually from 1s. 6d. to 2s. 6d. per cent. Banks usually balance their books at six months' end, at which time the pass books are balanced and ruled off.

For an overdrawn account an entry may appear on the debtor side of the pass book for bank charges to cover interest on the overdrawn amount.

A balance for you will find interest added to the credit side.

Business Documents.

Promissory Note.—This may concern an individual rather than a firm. It is a written and signed promise to pay—without condition—on demand, or at a specified date, a specified sum of money to a specified person or to bearer.

To be official the promissory note must have on it the "ad valorem" (according to value) stamp. A promissory note differs from a B/E in that the former may be drawn up by the debtor

himself and need not be accepting. The debtor completes the document and hands it over to the creditor.

NOTE.—It would pay many responsible mill managers who have progressed from the practical side of the industry, to at least read a good elementary work on commercial book-keeping.

Cheques.—A crossed cheque has two parallel straight lines drawn across it more especially with the expression & Co. put between the lines, but may have such terms as "not negotiable," "under £40," or even the name of the banking firm instead, or more than one of these expressions.

A crossed cheque has its chief merit (and in a sense its chief defect) in not being exchangeable for cash at the bank upon which it is drawn. It must be paid into the bank, and they will collect the amount from the banker specified and place the amount to the credit of the person or firm paying in.

The smaller or left-hand part of a cheque when in the cheque book is termed the "counterfoil," the part torn off being the "cheque" proper. To obtain a new cheque book the principal party concerned must personally apply, or, if a clerk, must present a written order signed by the Principal.

When a cheque is made payable to *Bearer* it is payable to anyone who may present same—subject sometimes to identification—and a "Bearer" cheque may not require endorsing.

If a cheque is made payable to "order"—which is the more usual method—it must be endorsed on the back by the payee before cashing. "Endorsing" by writing the name at the back, preferably at the perforated end.

Presenting a cheque (not crossed) means offering it at the bank named on cheque and requesting cash. A cheque becomes "dishonoured" if the bank refuses payment because the "drawing" person or firm has not sufficient money in the bank.

In such cases the bank may write R/D—refer to drawer—or N/S—not sufficient on the cheque.

An "open" cheque means one not crossed, and for which the payee may expect cash on presentation.

A "blank" cheque is signed by the drawer, leaving the amount to be filled in by the payee or other trustworthy person, who may later become more *au fait* with the requisite amount.

A cheque becomes invalid if it be "undated," "ante-dated," "post-dated," or bears a Sunday date. "Ante" means before and "post" means after the true time.

Making out a cheque requires the amount to be stated in words in the body of the cheque and in figures at the bottom left-hand corner.

The drawer must sign his own name and that of the "payee."

Double marking of the amount guards against fraud and vagueness.

Amount in figures only might have cheque returned and marked "incomplete," and the wording is almost more legal than the figures.

Entries on the counterfoil should be date, amount, payee, and what for.

Bad Debts.—Cotton spinning mills sustained heavy losses by "bad debts" in 1922 owing to customers ordering and receiving yarn and not paying for same. Some customers became insolvent and bankrupt, such a thing as suicide was not unknown, and many yarn orders were cancelled on very slight provocation or alleged defects in the yarn. Such losses must be "written off." The "bad debts" account may be debited and the debtor credited with the amount.

Stock-taking.—Most cotton mill people are well aware of stock-taking times by having to make an individual counting or assessment of cotton, bobbins, yarn, cloth, and other property that may happen to be about their machines.

Foremen may be responsible for this being done, and prominently marked for quick noting by the stock checkers.

Warehousemen, managers, office men, and directors are intimately connected with stock-takings which periodically reveal the exact business and financial position of the firm, and may be done preparatory to an audit by a responsible accountant.

Stock-taking implies a valuing or possibly a re-valuation of all the goods and property, plant, fittings, machinery, appliances belonging to or being used by the business or firm.

Stock-taking reveals the amount of profit or loss for the period taken.

Stock-taking may precede the final balancing or making up of the mill books for the period taken.

A *Postal Order* (P.O.) is an order made by one post office to another one for the payment of a specified sum, which is first paid into the first office together with a small charge. The second office need not be specified by the first nor the payee.

A *Money Order* (M.O.) differs somewhat from a P.O. inasmuch as it is an order from number one to a second specifically mentioned office for payment of a sum of money (a limit of £40) to a specified person.

If crossed, the order may be left blank as to payee.

Book-keeping.

Dr. and Cr.—The credit side of an account is the right-hand side, and to credit a person or firm with goods or money it is entered on that side.

To debit is to charge against and must be entered on the left-hand side.

A creditor is a person who has money or goods owing to him, while a debtor is a person who owes something.

Balancing.—To obtain the gross profit on transactions for any number of cases, or for any period of time from the trading account, the total amount from sales may be deducted from the total expended in purchases, and also take stock by ascertaining the amount and value of unsold goods.

When the assets side of an account exceeds in value of the liabilities side the person or firm is said to be *solvent*, but for the opposite condition the term would be insolvent. An excess of assets might be termed "capital." An excess of liabilities would be called "deficiency."

Double Entry.—A "transaction" really means a "transfer" or "exchange" and involves two sides or two parties, the one who so to speak gives the money or goods, and the other who receives the same.

If weaving Co. A pays spinning Co. B £1,000 for yarn, then A might have a double entry in the books which in one case would show

Dr. Spinning Co. B. Cr.
To cash, £1,000

and in the other Dr. A's cash account Cr.
By B, £1,000.

Double entry is a great check on errors.

Agents v. Merchants and Direct Selling.—If a person connects a spinning and a buying firm so that the spinner sells yarn to the weaver, doubler, manufacturer or other responsible parties, and yet only receives the standard commission from the spinner, he is a yarn agent.

If such an agent re-sells the spinner's yarn at a higher price then he becomes a merchant and is directly responsible to the spinner for payment and delivery, whereas the first agent is not responsible unless he receives an extra ½ per cent. from the spinner and becomes a guaranteeing agent.

An agent introducing new business to a spinner in this way may have some claim on extended business between the same parties even if such business is done directly. It is legal for a person to make known whether he is acting as an agent only, or as a merchant.

If a spinner can do direct business with a doubler or weaver he not only saves the 1 per cent. commission but may hold very direct communication in regard to possible defects in the yarn, amount and time of delivery, and further business.

A yarn agent on change sometimes acts more like the weaver's

agent than the spinner's, especially in times of poor business. The agent may gauge the market by getting prices for say 30's or 60's twist from quite a number of spinner's representatives, take these prices to the customer; on his request, try to get a reduction in price and finally act as intermediate for a transaction for which the spinner pays all the commission to the man who has served the weaver at least as much as the spinner.

Bills of Exchange.

Practically trained inside mill men, becoming head general managers and responsible for cotton and yarn transactions, may be called upon to deal with Bills of Exchange, and at first find the same a little difficult to understand and deal with.

A person drawing a bill, agrees that when it is duly and properly presented, it shall be accepted and paid.

If it become dishonoured he will compensate a holder or endorser who has become obliged to pay it, so long as the requisite legal steps have been taken. When a person draws a bill, he practically undertakes that upon its presentation to the "Drawee" it shall be "accepted."

If a person endorses a bill by writing his name across the back, he undertakes to compensate a later endorser, who takes proper legal steps, and practically takes upon himself the responsibility of a new drawer.

Bills of Exchange are very important and much used legal documents which may especially facilitate business in raw cotton between Lancashire and Alexandria or an American cotton market. Also yarn or cloth transactions between this and other countries. There are many detailed methods of operation and various terms used in connection with "Bills of Exchange," and every spinning or weaving firm or agent touching them, needs some person who understands their intricacies; or at least should be able to refer to such a person.

Bills of Exchange or "Drafts" may take the place of payments in notes, cheques, or coins.

Bills of Exchange are stamped and certified promises to pay a stipulated sum of money at a certain future date. It is possible that a Bill of Exchange may enable a creditor who has funds in the hands of another person, to transfer those funds, or part of them, either to a third party or to himself.

These documents may be employed in order to suit the custom of the trade concerned, or when it is inconvenient to make the payment at once in cash.

A trustworthy firm wishing now to purchase certain goods but

not having ready money, may have the goods invoiced to them, and the selling firm may draw for the buyer's acceptance.

A three months' bill which must be signed and accepted, thus making the buying firm legally responsible for paying the money at the time stated. Discounts in such cases are not allowed.

A Bill of Exchange is a negotiable instrument and may be exchanged for cash.

One firm may owe another large sums and not be able to pay cash down, although the cash is badly needed by the seller. The buying firm having good assets and a good name may accept a Bill of Exchange drawn up by the seller, who can then convert into cash, since a Bill of Exchange is a negotiable instrument.

A Bill of Exchange could be changed for cash by a discounting broker, who would not pay quite the full amount to the seller.

EXAMPLE OF WEEKLY REPORT OF SPINNING MILL,
Week ending.....1920.

COTTON.	AMERICAN.	EGYPTIAN.	Total.
Stock of cotton last week in bale . .	689	75	764
Purchased this week. Recd. not fixed .	5	—	5
Total	694	75	769
Used this week	44	4	48
Present stock	650	71	721
Stock in process	246	53	299
	896	124	1,020

	775 B/s. or	325,500 lb.
.....Bales.....Futures =		
Add yarn in stock	= 175,640	,,
Total cotton and yarn	501,140	,,
Yarn on order . .	480,175	,,
Cotton to buy		
Cotton in excess . .	20,965	,,

YARN.

	Beams.	Mules.				Total.
		American Twist.	American Weft.	Egyptian Twist.	Egyptian Weft.	
In stock last week .	53 686	42,990	34,904	32,984	7,938	172,502
Spun during the week . . .	4,435	6,730	5,590	2,708	—	19,463
Add cellar gain .	266	404	335	162	—	1,167
Total . .	58,387	50,124	40,829	35,854	7,938	193,132
Deduct delivered during the week .	9,553	1,151	5,167	1,095	526	17,492
Present stock . .	48,834	48,973	35,662	34,759	7,412	175,640
Yarn on order . .	236,588	75,781	41 172	112,864	13,770	480,175
To spin . . .	187,754	26,808	5,510	78,105	6,358	304,535

	Beams.	Mules.			
		American Twist.	American Weft.	Egyptian Twist.	Egyptian Weft.
Average counts spun . .					
„ hanks per spindle .					
„ „ rovers . .					
„ cellar gain . .					

Yarn test — Counts — Conditioned

	American.		Egyptian.				
Cost of mixing this week							
Loss of cotton, including card . . .							
	Twist.	Weft.	Twist.	Weft.	E.R.I.	A.T. (2).	A.B.M.S. (2).
Average counts delivered	37·56	53·53	56·00	54·00	38·00	26·00	9·46
Average price of yarn delivered . .	40·98	38·01	37·29	31·50	31·39	28·75	24·06
Average price cotton mixed . . .	21·20	21·20	25·20	25·20	25·20	16·73	11·34
	19·78	16·81	12·09	6·30	6·19	12·03	12·72
Wages and expenses .	10·50	16·25	17·75	16·25	10·50	8·00	9·50
Nett margin . .	9·28	·56	5·66	9·95	4·31	4·03	3·22

Gain on the week £207 4 5 — Gain to date £415 13 9
Loss on the week £ — Loss to date £

Electric energy — Engine worked 24 hrs. — mins.
Coal consumed—tons, 82. Price 40s. — Cost nett £164.
Indicated H.P. — Cost per I.H.P.

In making any comparisons with current conditions due regard must be paid to the special conditions of wages, coal, and many other items, prevailing in 1920.

CASH ACCOUNT.

Dr.		Cr.	
To Balance . .	£33 4 7	By Loans repaid .	£4,019 11 4
„ "Futures" . .	— — —	„ 'Futures" . .	184 2 11
„ Loan deposits .	230 10 2	„ Cotton . . .	541 2 2
„ Sundries . .	0 14 3	„ Wages . . .	617 13 1
„ Yarn and waste .	3,089 0 7	„ Other expenses .	20 4 7
„ Bank withdrawals	5,371 12 5	„ Bank deposits .	3,316 2 3
		„ Balance . .	26 5 8
	£8,725 2 0		£8,725 2 0

BANK BALANCE.

Credit.		Debit	
Margin a/c	£7,188 5s. 2d.	. . .	£39,912 8s. 7d.

LOAN ACCOUNT.

Balance as per last statement £48,464 9s. 9d. | Present balance £44,687 18s. 10d.

COTTON : PRICE FIXED.

Date.	No. of Bales.	Points On.	Price.	Mark.	Quality.	Delivery.

COTTON ON CALL.

No. of Bales.	Points On.	Call Month.	Mark.	Months to be Delivered.

YARN SALES.

Date.		Weight.					Counts.	Price.	Terms.	Delivery.
		Beams.	Warps.	Bundles.	Cops.	Total				
									Per cent.	
Jan.	21				560	560	16 R.T.	16	4	
	,,				2,800	2,800	38 E.R.T.	30	3	
	25				2,000	2,000	16 R.T.	15½	4	
						5,360				

	Beams.	American.		Egyptian.	
		Twist.	Weft.	Twist.	Weft.
Average price of yarn on order .					
,, ,, cotton bought .					
Margin					

YARN DELIVERIES.

From . . . 19th Jan.
To . . . 25th ,,
17,492 lb.

	£	s.	d.
Total amount of yarn accounts owing . .	6,413	14	0
,, ,, due 25th Jan.	4,277	9	6
,, ,, ,,			

Cotton paid for . . . 340 bales.

Overdue accounts, £3,454 3s. 0d.

Machinery working—cards.....
,, ,, —rings.....
,, ,, —mules.....

Old order (33,267 lb.).

Manchester Shipping Houses.

A good average size of shipping house has many departments, and needs very able men and a great deal of capital—practically as much as a large spinning mill. It is not anyone who can get beyond the inquiry office of some of these shipping houses. A large

one might have the following departments: Yarn department, cloth department, testing department, pressing department, storage, loading rooms, manager's room, general offices, telephones, easy access to cabling facilities.

Besides facilities in Manchester, there must be competent agents in the foreign countries with which business is done, and in each case storage warehouses. Some have their own hydraulic presses for baling. There are several central press houses in Manchester.

High-class shippers often buy yarn and cloth, subject it to their own inspection and testings, and when finally accepted by them, impress the same with their own mark or marks, and assume responsibility according to the terms of their contracts both for buying and re-selling the goods.

Well-established houses may obtain and retain business abroad. They are specialists in export and import duties, conditions, and tariffs. They either keep linguists or are in easy touch with them. In tariff charges it may make a distinct difference selling 49's as against 51's owing to tariff increase at 50's.

Two shades in bundle yarn, or a little extra twist in one lot than another, may give different effects in dyeing or mercerising..

Liabilities.—A spinning or weaving concern or a company of any kind, by the term "liabilities," may denote the whole of its debts, and possibly also contingencies that might arise and involve financial matters.

Becoming "surety" or "bond" for some person or firm, possible dishonouring of bills, weaving firms or yarn agents owing spinning firms for yarn and going bankrupt, weaving firms getting yarn orders cancelled for alleged yarn defects after the spinner has "covered" yarn sales by raw cotton purchases and prices have gone down. These may be regarded as contingent liabilities.

The Invoice.—One of the most common business documents or expressions. It is a fuller expression than "the statement," and is itself a document which gives full particulars as to designation, quality, quantity, price, discount (if allowable), sold and sent to a customer; referring to yarn, the counts of yarn, weight, contents and marks of each skip or box, gross and tare, and any charges.

When the weaving mill receives the skips of yarn and the invoice, the invoice contents may be compared with the goods delivered, discrepancies being reported by weaver to spinner.

Possible foreign customers for yarn or cloth may occasionally ask for a "pro forma" invoice, which is practically an experimental one not actually accompanied by goods. Such an invoice enables the possible customer to ascertain the current price of the goods, the import duties, the method and cost of packing, discount, time allowances, and general terms affecting the final cost of the goods.

A *statement* is an account rendered by some firms at monthly,

quarterly, or other periods, to other firms they deal with, giving amounts and dates only of goods delivered since the last previous settlement, together with any charges, deductions for returns, allowances, or other items. A kind of abbreviated invoice and in a sense representing a reminder and a request for payment.

Stamp Duty.—Bills of Exchange, cheques, licenses, deeds, receipts for more than £2 of money, and many other documents, must every one be stamped as per scale, in order to make them legal and binding by law. The object is to obtain Government revenue.

Premium.—This term has several interpretations. (*a*) Mill shares may be at a premium by selling at a higher rate than the original cost. (*b*) An apprentice may pay a money premium for the privilege of learning the trade—not very common in the cotton trade, although not unknown. (*c*) Mills pay a "premium" for insurance against fire, and sometimes against accident. (*d*) Shares at a "premium" have a market value greater than their face value.

Quarter Days.—In England (not Scotland) these are officially stated to be as follows: 25th March, Lady Day; 24th June, Midsummer; 29th September, Michaelmas; 25th December, Christmas.

Share Terms.—Shares and stocks "at par" have their face and market values equal. "Below par" means that shares are at a discount, their face value being greater than their market value. "Above par" means that shares are at a premium, or have a greater market price than their face value.

Companies.

The limited liability movement has become almost universal in the cotton spinning trade, if possible, more than ever so since the great war.

The former great private firms of Messrs. John Wood Bros., and Messrs. Sumner of Glossop, Messrs. John Mayall and R. H. Buckley of Mossley, and very many others of like importance have long since given way to Limited Liability Companies. The immense size of modern spinning mills, the great amount of capital required, the economy of working mills containing 90,000 to 120,000 spindles, the ability to obtain loan money and share capital in small amounts from many people, have fostered greatly the limited liability movement. This is much more true of spinning than of the smaller weaving mills.

Oldham has developed and maintained the limited liability movement to a greater extent than any other town in the world. Not only in Oldham but to a less extent in other Lancashire towns, the Joint-stock Company occupies the position of the average person's bank in taking care of invested money either in the form of loan

money or share capital. Shares may usually be sold or loan money withdrawn at reasonably short notice, and the amount of loan money that has been lost in spinning companies is not much more than the amount lost in banking companies, while the interest is much more.

The post-boom crises has, however, for the time being made many investors very timid along these lines, and it is difficult to foresee what will presently happen in this direction.

Amalgamations, Combinations, Trusts.

There are several very successful, very large, and very well-known amalgamations in connection with the British cotton trade; among the more notable being the Fine Cotton Spinners' Association, Ltd., and Messrs. J. & P. Coats, Sewing Cotton Co. Writing in August, 1922, the "Crosses and Winksworth combine" is now assuming very large dimensions. Also the Howe Bridge Co.

The reflotation of mills during the boom centring around 1919-21 led to quite a number of other combinations of cotton firms being formed. Presumably such combinations centralise control and administration, while also permitting highly skilled experts to specialise along certain lines, and the production of certain classes of work to be assembled in certain positions. In buying and selling facilities and in various other ways it is probable that these amalgamations and combinations foster quantity, quality, and cheapness of production. There are many men, however, who consider that individual enterprise and ability are better fostered by the separate and independent control of mills, and also by one individual mill competing against another, the public would sometimes do better.

The cotton industry in Great Britain and in the world generally, is so very gigantic that it becomes a difficult matter for any one or two combinations to exercise any very general control over a long period. On the other hand, large scale production should be favoured by immense quantities of yarn being required, practically alike in counts and quality.

This is true alike in regard to single yarns, doubled yarns, and woven cloth, but more than any other in the single yarns, 20's, 30's 60's, 80's, or 100's yarn may be produced much the same all over the cotton districts, and production would be simplified, cheapened, and increased, if combinations and exigencies of trade permitted certain mills to confine themselves to certain counts.

The years immediately succeeding the war demonstrated that in many articles (not cotton), it was not good for the general public that any firms should have monopolies.

Apparently our cotton spinning and weaving industries are too gigantic for any such monopoly to exist therein.

Going a little outside spinning and weaving we have notable

examples of combination in the Bleachers' Association, the British Cotton and Wool Dyers' Association, the Calico Printers' Association, the English Sewing Cotton Co.

Circular Sent Round in Forming New Spinning Company (Pre-war).

1. The contents of the land, eight acres or thereabouts.

2. The price by the company to be £3,200 (£1,200 as a deposit, £1,000 as loan money, £1,000 as fully-paid shares—£3,200 equals 1d. per yard at twenty years' purchase.

3. The land is absolutely freehold, and is being sold as such with no tie at all on it.

4. The proposed nominal capital about £80,000. It is suggested to call up only about £2 per share.

5. The architects have verbally agreed to find £50,000 among customers who will be expected to become the contractors.

6. Some bank (name we omit) probably find £20,000 on loan.

7. The number of directors to be seven.

8. The qualification of each director to be two hundred £5 shares.

9. The proposed salary of each director to be £80 per annum.

10. The first directors to hold office for not less than five years or so long as they hold the qualifying shares.

11. The directors will fix the kind of mill which it is found most suitable to build, but it is intended that it shall be one for cotton. It may be (1) all rings ; (2) all mules ; (3) half rings and mules ; or (4) more or less of each.

12. The directors' qualification, plus the salary, if the time is left out, will work out approximately to an investment of 25 per cent.

Minimum Number of Shares each Contractor and others are expected to take up on a 90,000 *Spindles Mule Spinning Mill.*

Shares.	
400	Architects.
1,000	Cotton brokers.
2,300	Machinists.
2,000	Builders.
1,000	Concretors.
1,400	Directors.
1,000	Engines.
500	Fire escapes and sprinklers.
1,000	Steel and iron constructional engineers.
500	Share brokers' underwriting at 1s. per share.
200	Boilers.
400	Shafting and millwrighting.
200	Strapping.
400	Plumbing, painting, skips, etc.
300	Electric lighting.
50	Secretary.
100	Salesman.
100	Manager.
100	Auditor's underwriting at 1s. per share.
200	Part purchase money for land.
3,550	Public.
1,000	Solicitors.
1,000	Yarn agents.
200	Oil merchants.
200	Carriers.
1,000	Waste dealer.

Turn-over.—In spinning it may mean the total weight of cotton bought, the total weight of yarn sold, the total amount of money involved in these transactions during a specified period, whether it be one week, one month, one quarter, one half-year, or once per annum.

In weaving it may mean yarn bought, cloth sold, money involved in these transactions.

Turn-over for a spinning or weaving concern may have the more restricted meaning of total sales only.

As regards the bank, it may mean the total of the debits or credits placed to the firm's accounts for a specified period.

Trade Mark.—Some spinning or weaving concerns adopt trade marks for their goods and seek to build up a reputation for such goods, that will lead to a demand for that mark as opposed to similar goods by other makers. Perhaps trade marks are more common for cloths than for yarns.

The legal protection in regard to a trade mark applies only to the particular symbol or identification mark invented and confined to those particular goods. The trade mark may be geometrical or other figure, or it may be an invented name composed of parts from the names of different members of the firm and compounded into an original designation.

A trade mark itself is legally protected from infringement, but not so the goods themselves, as they would be in the case of a book copyright, or a patented mechanical device.

Payment Expressions.—C.O.D. means "cash on delivery." "Prompt cash" means payment in two or three days, and for cotton yarn sold Manchester terms obtains an extra ½ per cent. discount as against cash in fourteen days.

Cash or "net cash" may imply payment in about ten days. "Prompt cash" less four months, means payment in one or two days, less four months' interest at 5 per cent. per annum, a method not much used for cotton yarn or raw cotton.

"Cash against documents" means payment on delivery of bill of lading.

"Documents against acceptance" means that the shipping documents may be handed over to the buyer when he has "accepted" the bill of exchange.

If the last term be altered to "documents against payment" it means the Bill of Exchange must be honoured or paid before the shipping documents are handed over.

In cotton, yarn and cloth transactions, "tare" is a much used expression, meaning the weight of "bagging" or canvas in cotton bales, the weight of skips or boxes for cotton yarn, or "casks" or "sacks" if cop yarn or reeled yarn is packed in such a form. "Average" tare is often sufficient for cotton bales, owing to thou-

sands of similar packages, containing similar material, being similarly packed.

Cotton dispute cases regarding tare may be tested by "real" tare or actually weighing the tare from some bales. Yarn skips, boxes, or casks, are not standardised and need invoicing and checking by "real" tare or actual weighing.

A Copyright is the legal ownership of a printed publication or the right to print and publish something which belongs to the author.

Copyright begins with publication and in the first instance belongs to the author, but may be sold by him to another firm or person.

A copyright may endure in England for the life of the author and for fifty years afterwards. To be quite safe, a copy of the book should be sent as soon as printed and published to the British Museum.

A "long" bill may have a long term to run, six months or more, while a "short" bill may be payable "at sight" or "on demand," or in less than ten days.

Delivery Positions.—There are several very common and much used expressions in regard to position of delivery of goods sold; such as, "Loco," F.O.B., F.A.S., C. and F., C.I.F., Franco.

"Loco" means that the price specified is for goods at the works or where they happen to be at the moment without any transit charges whatever.

Goods may be F.O.R., free on rail in town of production. F.A.S. is occasionally used, and means the goods are delivered free by the seller alongside ship, but includes no charges in relation to placing aboard ship (see paragraph 1 in this chapter).

Freight Charges.

Of recent years freight charges have varied considerably and will probably vary for some time to come. In April, 1923, the current rate for cotton from Alexandria to Liverpool was given at 25s. per ship's ton of 40 cubic feet. At that time shipowners were wanting to increase the rate, while Liverpool and Manchester Cotton Associations were asking for lower rates.

Cotton Spinning Costs.

In April, 1923, a leading Authority estimated as below, taking as a basis an Oldham Mill of 100,000 spindles, 36's cop twist and 42's cop weft. For a week of 48 hours a weekly production of 56,000 lbs. weight of yarn was assumed; also a capital of £2 10s. per spindle, plus 10s. per spindle for stocks and working capital.

Trading expenses were quoted as below :—

Wages, salaries and Health Insurance	£32,000
Coal	4,500
Other expenses	8,775
Depreciation	12,500
Interest on capital employed, loan money, etc.	15,000
Director's fees and tax	1,000
Insurances for fire, replacement, etc.	1,100
Local rates	2,000
Inland Revenue Taxes	5,000
	£81,975

Upon this basis it was calculated that the cost per lb. of yarn production would be 7·03d.

Brokerage, discounts, waste credits, cotton loss, and cellar gain were not included in above.

Taking "Futures" at 14·60 and paying 200 points on it was calculated that the yarn would cost 26·43 pence before adding any profit; taking mule yarn 36's cop twist and 42's cop weft.

For ring yarn on beams the Federation basis of 1 ring spindle to equal 1½ mule spindles was taken.

It was assumed the capital required would be £3 15s. per spindle, and 15s. per spindle for stocks and working capital.

Taking "Futures" cotton at 14·60 pence, plus 250 points on, with ½ per cent. brokerage, the cotton costs were given at 17·19 pence.

On above data it was calculated that the cost of production would be 29·01 pence per lb. for 36's ring yarn on beam.

Assuming mills to be working alternate weeks only, it was estimated that 4·4d. per lb. would be added for the stopped week.

The full calculation for the mule yarn was given as below.

"Futures," 14·60, points on 200, brokerage at ½ per cent., ·08 = total, 16·68 cotton costs.

12 per cent. waste or cotton loss, after allowing for cellar gain on the yarn made cotton cost up to	18·95
Add cost of spinning as above given	7·03
	25·98
Less received for waste	·35
	25·63
Add yarn discount at 3 per cent.	·80
Cost per lb. of yarn =	26·43

Cotton Standards.

During the Summer of 1923, American standards and classifications for American cotton came into force, instead of the Liverpool standards previously obtaining.

A Current Account (A/C).

This comprises a detailed Dr. and Cr. statement copied from the ledger, containing an account of the transactions which have taken place between your firm and any other person or firm over a stated period.

Agent.—Contracts and arrangements properly made by a duly accredited agent, are binding upon any spinning, weaving, or other firm.

Every manager, salesman, director, buyer, clerk, or even a workman may be a lawful agent upon occasion.

Broker.—The term agent is generally applied to a yarn dealer, while the term broker is more often applied to a cotton dealer. A yarn agent may be employed by a spinning firm to sell yarn, and a broker may be employed to buy cotton, yet both be intermediate agents of the mill. The fee charged by a broker is sometimes termed brokerage, and by a yarn agent it is termed commission.

The term "per pro" or "per procuration" may mean the power given to an agent or clerk to sign letters or documents of some importance on behalf of a firm or principal.

Depreciation.

Depreciation is a periodical deduction on account of diminished value of buildings, machinery, or other property, on account of age or wear and tear.

Depreciation may be an annual deduction from values at a fixed rate per annum, or on a percentage basis. Suppose a pair of self-acting mules cost £1,000 and the life of the mules is taken at twenty-five years, subject to efficient repairs and any suitable improvements. The depreciation should be calculated to automatically allow for renewal in twenty-five years.

It is desirable that depreciation allowances of whatever form adopted, shall treat the normal capital so that it shall as nearly as practicable represent at any time the *real* value. It is a convenient method to fix average rates which can readily be written off yearly.

Our pair of mules might be depreciated at an average value, or at so much per cent. per annum on the diminishing value, or balance of the original asset. Few, if any, machines in the cotton trade depreciate very rapidly, because it is seldom that great improvements are now made or novel machines invented.

In the earlier war days machinery, buildings, etc., were of depreciated value, but high costs of buildings and machinery greatly appreciated values in the period 1919-20.

Big sums were paid out for E.P.D. and in other taxation in the boom years, but much E.P.D. money was due to be repaid 1921-22.

It is possible that want of recapitalisation might have led shareholders to call for larger dividends instead of keeping machinery good, whilst depreciation might have been charged against profits at Inland Revenue allowances without reference to great cost of getting new machines to replace old ones.

Depreciation did not pay E.P.D. or income tax.

The poverty existing in European countries, their lack of industrial activity, and their production of paper money instead of usable goods, helped to give very bad English trade conditions, 1921-22. Troubles in the Near East, India, Russia, and China, added to the evil.

Interest.

Interest is a money premium paid by a person owing money for value received.

It may be defined as the produce of employed capital. The writer has heard a managing mill owner reason thus: "If I lent money to a corporation I should receive interest therefor, or, if our firm borrowed money for the business they would have to pay interest thereon. Therefore when I put my own money into the firm it must be treated as loan money in the first instance and I must be credited with interest, before my profits or losses are estimated on the business risk."

Interest on capital whether it be borrowed capital, or an individual owner, or a firm's, should be a charge against or a loss to a business, and a gain to the capitalist involved.

Audit-Accountant.

An audit means a thorough examination of the books of the spinning or weaving mill, possibly every six months. It involves the accounts, securities, vouchers, stocks and other matters, with a view to detecting any possible fraud or error in the mill accounts and statistics.

An audit should be conducted by an accountant, who, being skilled in keeping and balancing books, and a member of a responsible independent firm, may be relied upon to enlighten the shareholders upon the exact standing of a firm.

Discount.

Discount is an allowance made upon the payment of a sum of money such as the more usual 2½ per cent. Manchester terms for yarn payments in fourteen days.

If you sell £1,000 of yarn at 2½ per cent., fourteen days it means you will accept at any time within fourteen days from the invoice date, a payment of £975 in full settlement.

Prompt cash discount is an allowance made on the immediate

payment of a debt, and Manchester terms for this being 3 per cent. you would only receive £970 if paid inside three days.

In some businesses there is a trade discount made by wholesale people to retailers, irrespective of time.

Discount allowed on yarn sold, is a loss to the spinner, and must be debited to the discount account. Any discounts received would be credited to such account. Cotton discounts, however, have been stopped, while yarn discounts are still maintained (1922).

EXAMPLE OF REPORT OF WEATHER IN THE COTTON BELT.

Observations Taken to 8 a.m. (American Time), 5th April, 1922.

Station.	Temp. (24 hours) To-day.		Rainfall (24 hours) To-day.	Weather To-day.
	Max.	Min.	Inches.	
Raleigh, N.C.	80	52	—	Clear
Charleston, S.C.	71	64	—	Cloudy
Augusta, Ga.	—	60	—	Cloudy
Atlanta, Ga.	78	60	—	Cloudy
Montgomery, Al.	82	68	—	Cloudy
Meridian, Mis.	—	66	1-10th	Clear
Vicksburg, Mis.	82	68	8-10ths	Cloudy
Shreveport, La.	70	62	2 2-10ths	Clear
Memphis, Ten.	80	58	7-10ths	Cloudy
Little Rock, Ark.	76	58	7-10ths	Clear
Fort Smith Ark.	70	58	1 inch	Cloudy
Oklahoma	64	56	2-10ths	Clear
Amarillo, Tex.	58	44	—	Clear
Fort Worth, Tex.	64	—	—	—
Abilene, Tex.	64	52	—	Clear
Taylor, Tex.	—	56	5-10ths	Clear
San Antonio, Tex.	78	58	—	Clear
Galveston, Tex.	74	66	9-10ths	Clear
North Platte, Neb.	56	48	—	Clear

EGYPTIAN COTTON.

Alexandria "Futures" (1922).

	Ashmouni.		Sakellaridis.	
	April.	June.	May.	July.
Tuesday's close	23·20	23·80	35·65	36·55
Wednesday's opening	23·50	—	36·10	37·10
,, close	23·60	24·15	36·40	37·35

Wednesday's receipts 1,063 bales, against 1,200 last year and 300 previous year.

Mill Books.

A fairly complete list of books kept for a cotton mill might be somewhat as below given, without reckoning the ledgers, banking and other accounts, and other standard office and accounting books :

1. Cotton requirements.
2. Cotton bought.
3. Cotton "Futures."
4. Cotton receipt.
5. Cotton mixing.
6. Cotton bale book.
7. Cotton samples.
8. Card wire.
9. Wrapping for draw-frames.
10. Wrappings for scutcherlaps.
11. Wrappings for fly-frames.
12. Hanks or counts on fly-frames.
13. Wages book for cardroom.
14. Spinners' wages.
15. Carders' and spinning overlookers' change of counts book.
16. Fly-frames production.
17. Spinning production.
18. Spinners' sett book.
19. Yarn wrap book.
20. Strengths test book.
21. Yarn order book.
22. Yarn forwarding.
23. Empty skips and boxes.
24. Details of samples sent.
25. Stock book for mule yarn.
26. Stores order, stores received, stores in stock.

Limits of Association Powers.

However powerful an association may be, such as the Master Spinners' Federation, Manufacturers' Associations, combinations of these, or even the Liverpool Cotton Brokers' Association, they cannot enforce laws which over-ride or differ from the Common Laws of England. The Association members can agree to loyally abide by the Association laws, offending members may afterwards find it difficult to do business, but in the event of any person or firm choosing to refer a case to the Civil Courts of Law, decision depends upon the country's laws.

Considering the magnitude of the transactions involved few cases go to law, but such cases have arisen in regard to raw cotton, spun yarn, and woven cloth.

(*a*) *Trade Unions.*—Trade unions among cotton operatives are intended as an aid to maintaining wages generally at a satisfactory level, and to prevent isolated instances of aggression by employers. An important feature is the employment of secretaries skilled in wages calculations and particulars, to check any lower rates than the lists from being paid. Wages conditions, fencing and health laws are reprinted elsewhere in this section.

It may be that cases of alleged tyranny are reported to the secretary for his investigation. An important duty of a secretary is to try and reconcile differences and disputes on any matter arising between employer and employed.

In this way trade is steadied and mills often prevented from stopping owing to misunderstanding.

A trade union secretary is practically a highly trained advisor to the operatives, and is usually supported by a representative

elected executive committee. There are many district unions of this *industrial* character, and several large amalgamations.

(*b*) What may be termed "*Craft Unionism*" cannot be said to be very strong in cotton spinning and weaving mills. Mule spinners and loom weavers seldom insist on any law in restriction of apprentices and are often glad to get learners who will stick to them for a time. In the cardroom it is the rule in some districts that a youth must serve either one or two years as a card tenter before becoming a full grinder, but this is almost the only fixed law of the kind in any ordinary spinning mill. Loom overlookers, slasher sizers and Yorkshire dressers, are sometimes a little keen on "craft unionism," but there is no such thing among the foremen of spinning mills.

Company Methods.—£1 shares are now the favourite dimensions for spinning mills, and a good many firms have aimed to have 10s. per share called up, although some have called up the whole £1 thus at any rate diminishing the interest payable on loan-money.

Shares of £1 each issued at a premium of 2s. 6d. represent actually 12s. 6d. per share paid by the original subscriber but only stand at 10s. paid up in the nominal statement, or as quoted in share-broker's list, the premium often going to the promoters who take the initial costs and risks of forming the company.

Share Transfer.—Shares in cotton spinning mills are usually transferable from one person to another at or near to the prices then ruling, and brokers will carry these transactions through at specified charges, attending to stamp duty and all legal forms. Spinning companies are usually prepared to take their part in such transfers, and transactions are very frequent. In prosperous times shares move up to a premium, so that a person may pay £2 for a £1 share fully paid, but will only draw dividend on £1. In bad times a £1 fully-paid share may sell for 12s. or other less figure than £1 fully paid, and the subsequent holder would draw dividend on £1. An original shareholder having paid 10s. per £1 share, would only receive dividend on 10s. when this represents the amount called up.

Association Company Articles.—In forming a company definite articles of association must be formulated stating the conditions on which persons may become shareholders, and the memorandum of association should be carefully examined so that promoters do not insert clauses likely to operate greatly against the interests of the ordinary shareholder.

The capital of the average modern spinning company has often been divisible into several distinct parts :—

(*a*) Ordinary share capital divided into paid or amount called up, and unpaid or amount yet available for calling up.

(*b*) Ordinary loan money from independent investors.

(*c*) Machinery, buildings, engines, furnishings, when paid for represent so much capital.

(*d*) "Good-will" is often put down as capital in a well established firm.

(*e*) Nominal or authorised capital may not be increased or diminished without approval by proper authorities, but the proportion of uncalled-up parts of share capital may be called up as required, and this represents a possible source of income of value for emergencies.

Ordinary or "continuous" loan money is usually withdrawable at short notice for amounts up to £100 or so and need not require a very long notice for longer periods, whereas debentures are more in the nature of share capital requiring a sale to obtain release from them.

Safety of Ordinary Loan Money.

Loan money has played a great part in the development and increase of our huge cotton concerns, especially in spinning mills. Ordinary shareholders, debenture shareholders, mortgage loans, ordinary loanholders, creditors for goods ; appear to be the people for consideration in a case of bankruptcy of a cotton mill. Debenture shareholders have a first call on limited dividends, but may easily lose their money in a bankruptcy case.

Apparently the mortgage people rank first for claim on any monies or properties belonging to the bankrupt company. Then come ordinary unsecured loanholders and creditors for goods and for work done. The shareholders might receive anything left over after the claims of all the foregoing had been fully met.

Assume a recapitalised concern now placed at £400,000 in shares of £1 of which only 300,000 shares have been applied for and 10s. per share paid in. This brings in £150,000. Unsecured loan money equal to £100,000 is obtained. A large financier or a bank advances £100,000 on mortgage and with first secured call and demand upon any properties of the company.

Trade in 1921-22 turns out continuously and exceedingly bad, so that the mill is shut up for many weeks and even when working the yarn is sold at or below cost price. Such a concern might lose possibly £1,000 per week even when stopped owing to the fixed expenses of which loan and mortgage interest would form a good proportion while fixed wages, rents, heating, and other items would be considerable. The company has a large demand from one of its creditors and cannot meet same. Depreciated values may leave little for loanholders after meeting the mortgage.

Cotton Mill Shares.

The boom years of 1918, 1919, and reaching to a little of 1920, saw mill shares increase to an almost fabulous value when the firms were sold or turned over. The author was in personal touch with a spinning mill in which shares were bought for £1 at the end of 1917 and sold for £26 in 1919. This was very exceptional, however, quite commonly the price of cotton spinning mills went up during 1919 from £1 5s. per spindle to £3 or even £4 per spindle.

In 1920-21 it was understood that to build and equip a new spinning mill for mules it would cost £5 to £6 per spindle, and for a ring mill from £6 to £7 per spindle. A really new spinning mill of course should have a life of 20 to 30 years before it, with little expenditure on buildings, engines, and machinery, whereas an old mill might cost a good deal in that time on the items specified.

Increased valuation per spindle does not increase production of yarn and must increase the cost of production if the man who has paid £4 for a share valued at £1 pre-war, can have adequate dividend percentage on his £4.

1921-22 transactions have often seen the 10s. per share paid up —sometimes at a 2s. 6d. premium—reduced in market price to 1s. 6d. or 2s., and there are cases in which the £1 share fully paid stands at the time of writing at little more than 10s. per share, so that mill shares have depreciated in value in many cases almost as rapidly as they were appreciated, although cost of new machinery has still kept very high.

At the beginning of 1920 "Lancastrian" cleverly stated the case for a typical spinning mill "turn-over" in a leading journal as below quoted.

"Consider the case of a 100,000-spindle mill which stands in the books of the old concern at 10s. per spindle, having been written down by depreciation at the rate of 10d. per spindle per annum, and which is bought by a new company at a price equal to £3 per spindle. If the rate of depreciation has been reasonable—and hitherto such a rate has been found in practice to be reasonable—and if none of the machinery has been replaced, the whole undertaking has a calculated life of twelve years. Under the old financial arrangements the concern must write off the value af its buildings and machinery, then standing at 10s. per spindle, in twelve years, which amounts to an annual charge for depreciation of £4167. If the new concern is to follow a sound financial policy it also must write off its buildings and machinery in twelve years, for the life of the plant is not lengthened by the mere fact that a sale has taken

place. £3 per spindle spread over twelve years is 5s. per spindle per annum, or a total annual charge for depreciation of £25,000.

"Consider now another aspect of the matter, the cost of the increase of capital. Suppose the balance-sheets before and after the sale are as follows:—

	(A) Before the Sale.	(B) After the Sale.
Liabilities.—	£	£
Shares paid up	30,000	200,000
Loans	40,000	150,000
Creditors	10,000	10,000
Reserve fund	30,000	—
	110,000	360,000
Assets.—	£	£
Buildings, machinery, engines, etc.	50,000 *a*	300,000 *b*
Stock of cotton yarn, and stores	50,000	50,000
Debtors	10,000	10,000
	110,000	360,000

a = 10s. per spindle; *b* = £3 per spindle.

"In this case the original company had £30,000 paid-up share capital, and £40,000 loan capital, paying probably for the loan capital 5 per cent. per annum interest. This makes £70,000 interest-bearing capital. The £30,000 reserve fund was capital which it used free of interest, and as this would be taken into account in the purchase price, it disappears so far as the new company is concerned.

"The new company has a paid-up share capital amounting to £200,000, and loans amounting to £150,000, for which it will pay 5 per cent. per annnm interest. Allowing 10 per cent. per annum dividend on the new share capital and 5 per cent. per annum interest on loan capital, this gives an average rate for the interest-bearing capital of approximately 8 per cent. per annum. The interest-bearing capital of the old concern was £70,000; that of the new concern will be £350,000, or an increase of £280,000 at 8 per cent. per annum interest, which means an increased annual charge of £22,400 in order to pay a dividend of 10 per cent. per annum on the share capital.

"The total increase for financial charges is therefore—

	£
Increased depreciation	20,833
Increased interest	22,400
Total annual increase	£43,233

"The new concern then will bear increased financial charges of £43 233 per annum for a period of twelve years. At the end of that time the old concern would have had to replace its plant at the prices ruling, and any advantage it possessed owing to not having been sold would disappear.

"£43,233 per annum for a 100,000-spindle mill means 103·75d. per spindle per annum, or 2·075d. per spindle per working week. Approximate productions for forty-eight hours for yarns from 30's to 100's counts are—

Counts . . .	30's	40's	50's	60's	70's	80's	90's	100's
Hanks per spindle .	22	21	20	19	18½	18	17½	17

"At 2·075d. per spindle increased charges, this means an increased cost of production per pound as follows :—

Counts . . .	30's	40's	50's	60's	70's	80's	90's	100's
Increase pence per lb.	2·8	4	5·2	6·6	7·9	9·2	10·6	12·2."

Mill Shares, Loan Money, Dividends.

Early in 1920 pressure was put upon the banks by the Treasury in regard to overdrafts and loans. Over 200 cotton mills changed hands, but above reason and shyness of prospective shareholders stopped other companies from turning over.

The screw having been applied by many banks, persons overloaded with shares began to unload more quickly than the markets could stand, and shares very rapidly depreciated in market value. In 1920, even after shares began to depreciate, considerable wages advances were made, but in 1922 these had gone back again. The loan money system is again increasing in favour in spinning companies, and the system is much more extensively applied to cotton spinning mills than to any other industry.

The limited liability movement in Oldham only disclosed one company unable to pay its loan money in full up to 1922.

Weekly or fortnightly auction sales of cotton mill shares became popular for a time during 1920-21 in different Lancashire towns, in addition to the ordinary and regular private transactions. During the earlier part of 1920 new companies mostly paid about 20 per cent. dividends, and of those not recapitalised some paid from 100 to 200 per cent. dividends. Before 1921 expired and during 1922 it became quite fashionable to pay no dividend at all. For a short time after the Armistice there was a cotton trade depression, then the great boom period accompanied by refloating of mills, followed again by the terribly bad trade of 1921-1922.

Costing.

When a firm is losing business and not getting full orders there is a tendency to drop prices even if profits and losses will not permit this.

Lowering of prices to obtain more orders by one firm, often leads to similar reductions by competitors when it is well known that neither can really stand it and make a profit.

It has often been well known on Manchester Exchange that certain mills were selling too cheaply in order to get some ready money, and in this way have lowered the whole tone of prices on the market.

Cost finding is not an exact science, and has been less so than ever of recent years since the war owing to large fluctuations in cost of cotton, coal, machinery, repairs, all accessories and mill furnishings; as well as in wages.

Material and direct labour do not represent probably more than 80 per cent. of the total cost of the finished yarn, and there are elements of overhead costings which fluctuate considerably.

Indicators.

Indicators or work measuring and registering devices are extremely valuable in cotton spinning mills.

They register in a very reliable manner the amount of work done by any machine in any length of time and enable a strong application satisfactory to employers and employees of the combined principle of piecework and a fixed price for a specified amount of

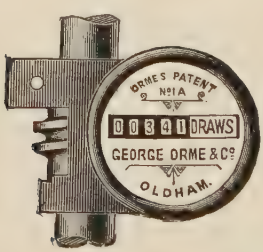

Fig. 11.

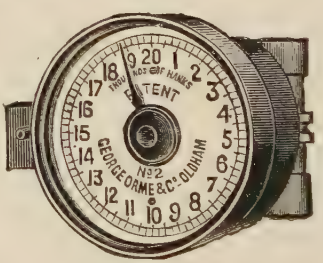

Fig. 12.

work. A self-actor minder in Bolton often receives a specified price per 100 lb. of work done, but in many other cases the rate is so much per 100 draws as registered by the indicator, Fig. 11, driven from the back shaft on which the driving worm is fixed. Ormes' indicators, as made by "Meter's Limited," are very generally used.

In Oldham the rate is usually so much per 1,000 hanks as

registered by the indicator shown in Fig. 12 driven from the long back-shaft.

For fly-frames or ring-frames the indicator registers up to 100

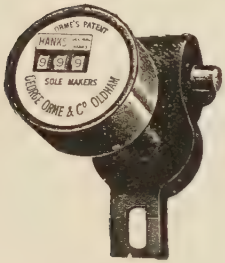

Fig. 13.

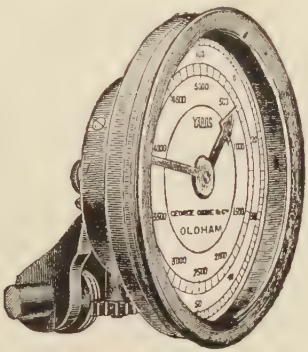

Fig. 14.

hanks, or up to 99·9 as shown Fig. 13, and then 00·0 stands for 100.

For yards run by a beam-warper or other machine the arrange-

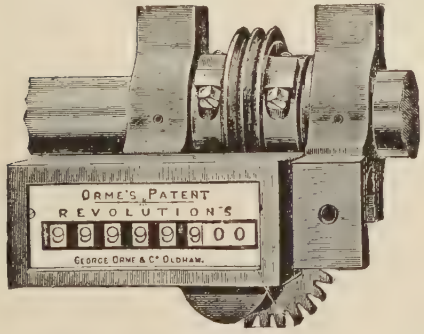

Fig. 15.

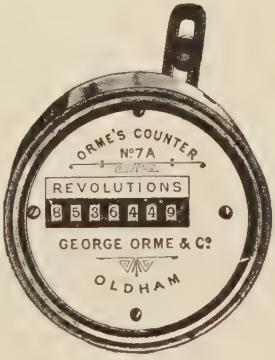

Fig. 16.

ments are made accordingly, the face or index lettered and numbered as in Fig. 14.

The two illustrations, Figs. 15 and 16, give an idea of what may be specially suited to recording the revolutions made by any revolving shaft, the registrations running very high.

Wages Increase in 1920.

One writer argued that such increases should take the form of shares in the cotton mills in order to increase the direct practical and financial interest in the business by the workers generally. It may be replied that in no other industry do so many of the operatives own mill shares so strongly as in the cotton trade.

The position and welfare of the operatives ; the present state and future development of the industry ; the practicability of the financial arrangements ; are all considered to favour the operatives becoming owners of more mill shares.

Cancelled Business.

One very unfavourable side of the cotton trade developed very soon with the trade depression in middle of 1920, and extended over a period of very many months.

Reference is made to the tendency to repudiate contracts which had been honestly placed while trade was good and prices ruled high.

Some of the best and most reliable spinners were hard hit this way. Having sold yarn ahead at a satisfactory price, they immediately bought either cotton on " call," C.I.F. cotton, or " futures " contracts to cover the sales and remove the gambling danger of price fluctuations. Trade rapidly deteriorating, prices going down, many yarn agents and yarn buyers went on the lines of condemning the yarn wholesale, refusing to take delivery, delaying payment for same and generally making trouble for the spinner. The Cotton Broker's Association see to it that cotton buyers fulfil their obligations and are sufficiently strong for the purpose ; but not always so the spinner or the weaver.

Not only was this amongst Lancashire spinners, agents, and manufacturers, but also it reached to overseas customers ; America especially coming into prominence in this respect. Some American buyers of English cotton yarn and cloth went so far that the Manchester Chamber of Commerce, at a crowded meeting, proposed a united stand against such cancellations where the terms of the contracts had been carried out.

London and Exchange Rates.

London has always been the world centre of foreign exchange trading, and in years succeeding the Armistice this was one reason why the price of sterling was low between Great Britain and America.

A business disorder followed the Armistice, but there was soon a great industrial improvement in 1919-20, followed again in 1921-

22 by a great depression in trade and heavy mill losses. All the time the British Government continued to collect heavy taxes so to meet both ordinary and extraordinary expenditures. No other country in Europe has done so well in National Finance in the several years succeeding the Armistice. Britain is not a creditor to the world and yet retains the dominant position in the world's carrying trade, having yet such enormous shipping resources that many of the ships have been idle during the depression months of 1920-22. London is the great market where Europe obtains Japanese yen, American dollars, Argentine pesos, Indian rupees, and other non-European currencies, as needed for making remittances to the outside world in payment for imports.

London purchases francs, lire, Fin. marks, Austrian crowns, and the like.

Appreciated Values, 1919-22.

Great trouble and trade disturbance were caused by the inflated costs of production, great increase in wages, appreciated values of all materials, appliances, and accessories, shortened working hours and lessened productions, resulting from the boom period.

Writing now in August, 1922, one can note the great trade depression, the inevitable reaction in values, the bankruptcies, the reduced values of shares following the all too brief boom.

Oldham is the greatest centre of the mill company system, with its many small or large shareholders and its loan money system. For many years it might be said that the capitalist class of Oldham was also the public or working class, and it was really public money controlling the mills and sharing first in the appreciated values and then in the depreciation.

Piecework lists, automatic indicators for registering hanks, revolutions, draws, or hours worked, practically standardised sizes of machines and speeds of machines, the production of indefinitely large amounts of yarn of almost standardised counts and strengths: these have long established the cotton industry and have led to costs of production being better controlled and better understood than in almost any other industry, but all costings were terribly upset by the fluctuating values of the several post-war years.

Calculations of costings have long been almost as easy of access to operatives and their leaders as to the employers.

It is well-known for example, that twist mules require more space than pin-cop weft; that double roving is more costly than single, and that combing is a great factor in increasing cost of production when it is resorted to.

A company with a small share capital and a large amount of loan money will thereby gain extra dividends on the share capital

in prosperous times, but in other times will have to find the loan interest and will find extra difficulty in finding dividend for the share capital. It is well understood that the share capital takes the greater risk of profit or loss while the loan capital is supposed to take an assured interest, and does so unless in case of bankruptcy or some agreed upon reconstruction.

In the boom period American cotton went from 8d. to 2s. per lb. and best sakel Egyptian from 1s. 6d. to 6s. or 7s. and more for a short time. Assume 20 per cent. loss on carded sakel, this would mean 20 × 18d. as against 20 × 72d. 20 lb. loss out of 100 lb. weight without taking into account value received for waste, represents a loss of 120s. on the 6s. cotton as against 30s. on the 1s. 6d. cotton. This obviously adds enormously to cost of production. For a short period there was income tax at 6s. in the £, E.P.D., local rates up 80 to 100 per cent. Wages increased 215 per cent. and general costings almost more during the short so-called boom.

Total costs for any item of expenditure, or any group of items over a fixed period, divided by weight of yarn produced, will give a good idea of cost of production in regard to such items.

Wages and expenses for American cotton were much about equal in pre-war times, but during the boom the expenses became approximately one and half times the wages.

Mr. B. Robinson, a well-known Oldham mill manager and an examiner in cotton spinning, prepared in May, 1921, for Oldham counts, a comparative statement of yarn prices as quoted below.

"48 hours were being worked as compared with 55½ hours pre-war. A mill of 100,000 spindles was taken.

1912.

Cotton	10·00	Yarn	13·00
13 per cent. loss	1·49	6 per cent. C.G.	0·78
Wages	1·20	Waste	0·25
Expenses	1·25		
Discount	0·39		14·03
	14·33		

1921.

Cotton	10·00	Yarn	19·00
Loss	1·49	C.G.	1·14
Wages	4·50	Waste	0·25
Expenses	5·25		
Discount	0·57		20·39
	21·81		

Total cost 3·3d. pre-war.
„ 10·5d. May, 1921.

"During short time the cost was more like 1s. 3d. per lb. The cost in May, 1921, was 3½ to 4 times that of the pre-war period. Taking any other branch of the trade they would find the same relative increase."

In profitable periods, mills with small share capital and large loan capital, have profited so much by the use of the loan money that they have declared very high dividends, thus giving a false idea of the real trading profits, or the profits that would have been made had the capital been all share capital without loan money.

Recapitalisation.

1922 proved beyond doubt that those who bought shares at full refloated and temporarily increased values and held to the shares, became for the most part very serious losers, and some of the greatest purchasers and reflo ting gentlemen, after enormous successes, afterwards met with sad reverses, those who first sold, and then came back again after a depreciation of values, receiving most benefit.

Writing in August, 1922, it may be said that cotton machine-making firms have continued to prosper and continued to charge greatly appreciate l rates for new machines and repairs, in spite of the very bad trade in England. The end of 1922 saw reduced values.

Bank rates have been greatly lowered and it is hoped this will benefit trade, but Indian and foreign tariffs have badly hit Lancashire spinners.

The tax of 33⅓ per cent. on fabric gloves from Saxony to England bids fair to hit Bolton spinners who sell yarn to Germany. America has considered a tax on the exportation of raw cotton.

Recapitalised mills have in many cases either large bank overdrafts or else other loan money which in times of depression added anything from ¼d. to ¾d. per lb. to cost of production. In one sense it may be said that a large share capital amount does not add to cost of production, but it certainly reduces the per cent. of dividend since the profit that would pay 6 per cent. on £100,000 will only be 3 per cent on £200,000 capital.

Manufacturers buy yarns from cheapest sellers of their class of yarn regardless of cost of production, or profit and loss, on the part of the spinner.

A dividend of 2s. per share may be a nice dividend on a share for which £1 has been paid, but if the £1 share is bought by another person at £3 then the 2s. per share becomes a very poor dividend.

Refloatation.

A specified dividend per share may represent a good per cent. on a small share capital, but become a very moderate dividend on a large share capital.

Pre-war the author bought coal at less than 8s. per ton for mill boilers, but during the boom the coal went up to 40s. per ton.

Insurance for spinning mills in some cases became ten times as high as pre-war, bank rate went up to 7 or 8 per cent.

As an instance of the effect of inflated prices it may be said that operative spinner's cotton shirts and cotton overalls were often purchasable in mill districts at from 2s. 6d. to 3s. pre-war, but were quadrupled in price in 1920-21. Again reduced end of 1922.

Fabric Gloves.

When the cotton trade slump came in 1920 it soon helped to make serious trouble for the glove makers of Leicester and other districts.

Pre-war an immense quantity of gloves was imported from Germany and Austria, and during the war and also in 1919 it came under the present writer's personal observation that almost any foreman or forewoman with training in making fabric gloves, could establish a small place with two or three skilled and many unskilled women and promptly obtain good profits from fabric glove-making.

In 1920-21 the return of Saxony to the glove-making industry and conditions of wages, exchange, and employment speedily helped the slump tendency to put a great many of the British glove makers in queer street, and one result was that continued agitation on the part of glove makers led to a clause in the "Safe-Guarding of Industries Act," designed to impose a very strong import duty against German fabric gloves.

Then it came out very prominently that a great amount of Bolton fine cotton yarns—about 80's combed especially—went to Saxony for this very purpose of making fabric gloves, and Lancashire spinners promptly made war against the proposed gloves duty, since the cotton industry was only just then very slowly recovering from a very bad depression and severe monetary losses. The fine yarns going to Saxony was a very material help to Lancashire fine spinners who submitted that a comparatively small body of glove makers would be helped by the proposed tariff at the expense of a very much larger body of fine cotton spinners, let alone at increased cost of gloves to British consumers. Mr. James Fishwich, then President of Bolton Chamber of Commerce, at once formally protested against the tariff. Although British makers of

fabric gloves would require a small amount of fine cotton yarns, this would not compensate for the irritation of Saxony glove makers.

Very quickly a powerful deputation representing the several Masters' and Operatives' Associations of Lancashire cotton trades, interviewed the Premier of England, Mr. Lloyd George, being introduced by Lord Derby, with Mr. William Howarth as chief spokesman. Mr. Howarth was then President of the Bolton Master Spinners' Federation, Vice-President of the Master's Federation, and an Executive Member of the Fine Spinners' Association. Sir William Edge, as M.P. for Bolton, took a leading part in helping on the deputation.

The Premier admitted himself as greatly impressed with the importance and strength of the deputation, and promised its views should have full consideration by a proper committee and in the House of Commons.

Later on this Committee reported in favour of the 33⅓ per cent. tax and the House of Commons voted for its imposition in spite of the representations from Lancashire Cotton Authorities, in which it was suggested that the comparatively small glove fabric industry would be helped at the probable expense of the infinitely larger cotton spinning and weaving businesses, as well as at the expense of the ordinary consumer. On the other hand it was suggested that the persons obtaining most benefit from the importation of fabric gloves into England, were profiteering importers, who bought fabric gloves very cheaply in Saxony but took good care that only a small proportion of the benefit reached the British consumer. 80's combed yarns were greatly in demand for fabric gloves and similar goods.

On 31st July, 1922, a statement was sent to members of the House of Commons from employers and operatives in the cotton trade asking for their assistance against the proposed tax of 33⅓ per cent. upon imported fabric gloves. With some limited exceptions the statement purported to be the considered opinion of the whole of the cotton industry comprising 50,000,000 spindles, 800,000 looms, and 500,000 workpeople.

According to this statement: "In 1913, the weight of yarn exported to Germany by Great Britain, was 51,905,400 lb. or a quarter of our total exports. Of this total 20,000,000 lb. was used for the manufacture of glove fabric, and fabric for other purposes than glove making, and made on the same machines.

"If the whole of the machines in England for the making of glove fabric were working full time they could not absorb 2,500,000 lb. of yarn."

It had been stated that only ½ lb. of fabric was required for one dozen pairs of gloves, but really fully 1 lb. of yarn was required for a dozen pairs. Practically all of the money paid to German

fabric glove makers from Great Britain was expended by them for fine yarns from Lancashire since Saxony glove makers use Lancashire yarns for gloves intended for other countries as well as England.

The Saxony glove makers have produced approximately 8,000,000 dozen pairs of gloves for their world trade from Lancashire yarns, but several other countries can produce the same sorts of yarn. The 33⅓ per cent. duty on Saxony fabric gloves will prejudice these glove makers against Lancashire fine yarns—largely 80's combed. It may be added that in spite of these strong efforts the 33⅓ per cent. tax was finally imposed on a Coalition Party vote.

Tariffs—The Other Side.

On 31st July, 1922, a strong protest was made by the Rubber Manufacturers' Association of Great Britain against the proposed American tariff on rubber goods exported from the United Kingdom to the U.S.A. It is computed that 70 per cent. of the rubber supplies of the world are consumed by the United States and Canada, and it appears difficult to show the need for American protection against United Kingdom manufacturers who only consume 12 per cent. of the world's supplies of rubber.

At least one very prominent Lancashire spinner supported the 33⅓ per cent. tax on fabric gloves and spoke strongly in its favour, and asked for strong duties against the importation of motor tyres into this country and particularly strong measures to prevent dumping of foreign motor tyres below cost in this country. To support this view it was pointed out that by this dumping 14,000,000 lb. weight of yarn was being lost annually to Lancashire cotton spinners who produced yarns for motor tyres. It was stated that the yarns used in motor tyres represented more than half their value.

Apparently some spinners of yarns for motor tyres supported the 33⅓ per cent. tax so that it could apply both to tyres and gloves.

Motor Tyre Covers.

A tremendous business has arisen during recent years in producing cotton yarns for motor tyre covers. America has apparently led the way in this particular direction.

Egyptian cotton has been generally conceded to be the best for this purpose although much American is used for the purpose.

Medium qualities of Egyptian cotton, spun to the comparatively coarse counts of 23's or 24's, appears to do better than similar yarns from American cotton.

The motor tyre cloth is exceedingly strong and long-wearing, and yet possesses necessarily the property of resiliency. It is reckoned to take about 6 lb. of yarn for each tyre, or 24 lb. for a set of four tyres. The assembly of a good number of individual 23's/24's single yarns into the finished article finds good work for the doubling mills. Tyre weights vary.

"*Lastings*" *cloth.*—A strong twill cloth composed of well-twisted yarns of either cotton or wool. Much used for the linings of boots and hand or other bags. Sometimes for covering what is termed church furniture. "Lastings" may be of plain weave, suitably dyed, finished with a stiff glaze finish, sent to South America, and used there by the natives for trouserings. Often about 24's weft and 20's warp, American cotton.

Board of Trade. Half-Yearly Report, July, 1922.

"Exports of cotton yarns for the six months ended 30th June last, show an increase in value compared with a similar period last year, the figures being :—

1922	£14,242,341
1921	£10,301,588

Piece goods, however, show a decline. For this year the figures are £67,391,014. In 1921 they were £75,104,452.

Our exports of cotton yarns and manufactures to Germany for the first six months of 1921 amounted to £55,557, and for the first six months of this year to £69,324. Our total imports of cotton gloves went up during a similar period from £269,623 to £467,745.

In a survey of the first half of this year, the *Board of Trade Journal* states that the slow industrial recovery which took place during the first quarter of the year continued during the second quarter. It was most marked in the textile trades, nearly all of which showed striking improvement.

In the cotton industry only a small proportion of the looms are now idle. In the wool textile industries activity is spreading from the top-making branch to the later stages of the worsted industry and to the woollen industry.

Even lace-making, which until recently was severely depressed, is beginning to experience improved trade; while the position in the jute and silk trades is considerably better, and the linen trade is more hopeful."

Cotton Exports.

"The following table, compiled from figures given in the Board of Trade Returns, shows details of the cotton trade in June, 1922, with comparisons for the same month last year :—

	June, 1922.	June, 1921.
Yarns, lb.	15,743,900	8,737,200
Yarns, value	£2,068,314	£1,248,127
Piece goods—		
Grey, square yards	117,991,800	53,402,300
Grey, value	£2,733,550	£1,374,702
Bleached, square yards	95,406,400	44,748,700
Bleached, value	£2,789,724	£1,929,343
Printed, square yards	38,994,100	24,054,?00
Printed value	£1,649,871	£1,446,312
Dyed square yards	59,515,000	30,434,200
Dyed, value	£3,262,854	£2,398,972
Total, square yards	311,907,300	152,639,500
Total, value	£10,435,999	£7,149,329

"As compared with May last, yarns show a decline of 5,023,400 lb. in weight and £1,473,302, while piece goods have dropped by £29,517,500 square yards in volume, and £1,108,558 in value."

Debentures and Loan Money.

Ordinary loan money invested in a cotton company without security ranks before ordinary share capital in a case of bankruptcy for a distribution of any assets available.

But mortgages come in front of either share or loan capital. A legal mortgage involves the company into executing a deed charging the mill properties to the mortgagee. A mortgage may in cases involve the deeds of the property with the mortgagee, who has full interest on his money as a loan. A mortgage may be defined as a loan with extra security.

Ordinary debentures or preference shares may have a first call on dividends as before ordinary shareholders, but the dividend may be at a fixed rate so that in times of small profits a debenture holder, like a loan holder, would do better than a holder of ordinary shares. *Per contra*, in times of good profits the ordinary shareholder would get the highest return of anyone for his invested capital, and in a case of actual bankruptcy would be the first to lose his capital.

A cotton spinning or weaving firm may have an "*Overdraft*" at the bank at any time by drawing out more money than the amount standing at the current account. Banks watch this kind of business carefully, charge interest on the overdraft and require security if done much. An "overdraft" differs from a specific loan by bank to firm.

Machinery Makers.

There is no doubt the close proximity of spinning and weaving mills to machine makers has materially helped the textile industry.

Some of the larger machine makers keep a staff of experts who are at the quick disposal of spinning and weaving mills in cases of special difficulty. The machinery firms have often fostered the technical schools with gifts of machinery and scholarships to their own apprentices.

Numerous repair shops are interwoven among the spinning and weaving mills all over the cotton district. Many firms are celebrated for producing accessories of one sort or another for cotton mills, such for example as Wilson Bros. for bobbins, skewers and shuttles, makers of driving belting, cotton ropes, roller leather, card cans, loom accessories, healds and reeds, and in short, of every accessory required in a cotton mill. Unfortunately, the chief factor of all, the raw cotton has to be carried thousands of miles before it reaches our spinning mills.

These spinning mills produce practically all the yarn required for British weaving mills, thread mills, lace makers, hosiery makers or other requirements, and in addition spin large weights of yarn for shipment abroad.

Not only do the machine shops supply the machines and skilled erectors, but also supply men to periodically repair the machines and bring them more up-to-date.

The foremen and managers of the spinning and weaving mills maintain frequent contact with each other and interchange ideas, to the mutual benefit of men and firms concerned.

Sometimes fitters trained at machine shops become foremen at spinning mills, and, sometimes the machine firms help to place cotton mill men in higher positions at home or abroad.

Writing in August, 1922, it may be said the English makers of cotton spinning machinery have been prosperous and busy during the last two years of English cotton mill depression; but unfortunately most of the machinery is for abroad.

Machinery Making.

English makers of cotton spinning and cotton weaving machinery have exercised a great influence upon the continued extension of the cotton industry. Few cotton mills in Lancashire and parts of adjoining counties are very far from machinery makers, and this has always facilitated repairs and renewals, thus helping to obtain maximum productions of yarn and cloth. Frequently the larger cotton machinery makers have helped to finance and aid in one way or another the building of new cotton mills, sometimes retaining a sufficient interest in a few firms so that intending purchasers of new machines might be taken through the mills, or, on the other

hand, to have new machinery ideas tested. There has been a tendency towards amalgamation of machine firms since the war.

Well-known names of machine makers are given below: Platt Bros. of Oldham, Dobson & Barlow of Bolton, Hetherington's of Manchester, Asa Lees of Oldham, Howard & Bullough of Accrington, Threlfall's of Bolton, Tweedale's & Smalley of Castleton, Lord Bros. of Todmorden, Brooks & Doxey of Manchester, Arundel's of Stockport, Joseph Stubbs of Manchester, Universal Winding Co. of Manchester, Thos. Holt's of Rochdale, Tatham's of Rochdale, Taylor, Lang & Co. of Stalybridge, Henry Livesey of Blackburn, The Northrop Loom Co. of Blackburn, Robert Hall & Co. of Bury, Hacking's of Heywood, Hattersley's, and many others.

Dronsfields of Oldham for roller covering and card grinding machinery, Orme's or Meter's Ltd. of Oldham for wages indicators, The English Card Clothing Co. and Horsfall & Bickham's for card-clothing, numerous makers of humidifying and ventilating apparatus, specialists in Jacquard harness construction, fire extinguisher makers, oil refiners, all these and others help along the gigantic cotton industry while carrying on their method of making a living.

"The Textile Manufacturer," "The Textile Recorder," "The Textile Mercury," "Cotton Factory Times," "The Manchester Guardian," and "The Oldham Chronicle," help to keep cotton mill men posted in latest methods and devices.

Bolton, Preston, Burnley and Blackburn papers also help more or less in this direction.

CHAPTER VII.

COST OF PRODUCTION.

The Limited Liability Movement.

The joint stock and limited liability movement has played an enormous part in promoting the building of huge cotton spinning mills in Lancashire and adjoining textile mill areas. Leading this movement was the Oldham Building and Manufacturing Co., Ltd. which was inaugurated in 1858, and which has long been represented by the Sun Mill Co., Ltd. of Oldham.

In 1921 there were 17,000,000 mule spindles and over 2,250,000 of ring spindles in what is known as the Oldham area, and controlled by limited companies. Mills of 100,000 to 115,000 mule spindles have been established as the most economical to work and manage since 1890 or sooner. Weft mules of 1,370 spindles, $1\frac{1}{8}$ inch gauge, twist mules of $1\frac{3}{8}$ inch gauge, about 1,200 spindles, requiring mill rooms of 130 to 136 feet width including passages. The writer has had charge of distinctly longer mules, but they were too unwieldy.

Pre-war mills of 110,000 spindles, requiring 24s. 6d. per spindle, might be in £5 shares, call up £2 per share and obtain the other £3 per share as loan money. Usually the loan money was readily obtainable pre-war and was seldom lost—in some districts never.

Spinning companies usually paid 4 to 5 per cent. interest as against $1\frac{1}{2}$ to 2 per cent. in the bank and so these companies came to be regarded as the chief banks for moderate capitalists.

The amount called up could be increased at will, but special legal powers would be needed to alter the amount of capitalisation, the unpaid capital being the backbone or fundamental asset in addition to machinery, buildings, and stock.

The definite part taken by shareholders in financing, managing, directing, and working in spinning companies, has materially helped in making efficient, capable, steady workmen, and in promoting many of these into positions as carders, overlookers, or managers, and finally as directors, thus practically becoming employers.

English success in the cotton trade has owed much to the

continual competition of new ability and talent, greatly helped by the technical schools since 1890, both day and evening schools.

There is keen rivalry among the individual limited companies as distinct from the large combines.

Size of Mill.

Take our typical mill of 110,000 spindles, costing 24s. 6d. per spindle. £5 shares, 17,000; £1 called.

Total money required	£134,750
Nominal capital, £5 × £17,000	85,000
Called-up capital	17,000
Loan money	117,750
,, ,, interest at 5 per cent. per annum	5887·5
Dividend declared only on paid-up capital of	17,000
Assume a profit of £9,000 per annum:	
Loan holders take	5887·5
Shareholders take	3112·5

$$\text{and } \frac{3112{\cdot}5 \times 100}{17000} = 18{\cdot}3 \text{ per cent.}$$

Profitable periods make loan money a great dividend increaser, since other people's money may require only 5 per cent. interest and yet make far more than this for the firm. In lean years the reverse holds good.

Two spinning firms of approximately equal size and covering the same class of yarn may produce approximately equal profits and yet declare greatly differing dividends—according to the amounts of paid-up capital and loan money respectively, the dividends being increased in fat times and diminished in lean times.

The great refloating years of 1919-20 saw many spinning firms refloated at two or three times the previous amount per spindle.

This does not diminish the actual profit which may be made, nor in one sense does it increase cost of production since the surplus before given might be still realised. The per cent. or rate of dividend, however, will be proportionately less as the capital is greater.

According to fire insurance assessors the price of buildings and machinery became inflated 400 per cent. and renewals paid for on this basis, during the boom years.

Causes of such inflation were the great boom in yarn prices, the English working hours reduced from 55½ to 48, the number of spindles stopped in Russia, Germany, France, and Austria, the general (but false) impression that trade would boom for years, and the difficulty of building new mills even at fancy prices.

Depreciation allowances are greater on higher capitalisations. In most cases shares were issued at £1 and 10s. called up, some

mills very shortly making further calls, but most others delaying calls as long as possible.

Three-fourths of our cotton goods are for export trade when in full cry. The rate of exchange, the poverty of importing countries, increases in tariffs, great cost of freightage, increased cost of production, shorter hours, dearer coal, higher wages, dearer accessories, have all influenced bad conditions. At the moment of writing German marks are about 3,500 to the £1 (4th August, 1922). Instead of one mark = 12d. we have 1d. to = 15 marks and great variations daily. Later on the mark value receded much more.

Increased capital does not increase production cost, but decreases dividend rate. In 1921 approximate relative increases in production costs for average 40's American were given at about 30 per cent. wages, 60 per cent. general expenses, 10 per cent. for extra capital: rates, taxes, insurance, depreciation, rank in working expenses.

Income tax and insurance rates went up ten to twelve times in 1920 against 1913. Actual mill wages went up 215 per cent. at the maximum. By November, 1922, serious reductions had been made.

Average Counts.

A mill produces 2,500 lb. of 30's, 3,000 lb. of 36's, 5,000 lb. of 40's, 8,000 lb. of 50's, 2,000 lb. of 60's. Find the average counts?

The rule is to find all the hanks and all the pounds produced. Then hanks divided by pounds always give counts.

Lb.	Counts.	Hanks.
2,500	× 30's =	75,000
3,000	× 36's =	108,000
5,000	× 40's =	200,000
8,000	× 50's =	400,000
2,000	× 60's =	120,000
20,500		903,000

903,000 ÷ 20,500 = 44 average counts.

Basis of Wages for Mule Spinning in Oldham District.

Probably one of the worst points about the spinners' lists in some districts is that they have permitted very great and most unfair variations in the wages paid to different minders working under the same list, in the same town, and in some cases even at the same firm.

The author has often noted such unsatisfactory conditions, and has often come into personal contact with extreme cases. In some instances minders have been working on old, worn-out, strained and broken down mules, with inferior cotton, and it has been quite

impracticable for a capable minder, with really hard working, to earn more than two-thirds of the wages paid to other minders, at the same time and in the same town with no more anxiety or work, owing to having good, well-conditioned mules and good cotton, while at the same time receiving the same amount of money for the same amount of yarn turned off. Good rovings and good machines increase production very greatly.

While variations in wages earned must always exist to some extent, it is a grand thing about the Oldham list that they cannot reach very extreme limits, because an employer is bound to compensate a spinner for working on poor machinery with inferior cotton, while, on the other hand, the operative has to share extra wages earned by good cotton and machinery with the employer.

The Oldham list is a speed list, and it is specified that for mules of 63-inch stretch, of any size and counts, running three draws in 50 seconds, a certain price per 1,000 hanks shall be paid, and allowances are then made for any variable conditions. It may be said that the basis of the Oldham list consists in arranging the rules and conditions so that the minders' and piecers' wages shall be within certain limits no matter what kind of machinery, cotton or counts be in vogue.

This is true more particularly as regards the minder of average ability. At tbe same time it must not be forgotten that it is a piecework list, so that an indolent or unskilful minder may come below the average, while an industrious and skilful minder may earn more than the average. Also, the minder on long mules receives more than the one on short mules.

In proportion to the size of mule the total wages on the ticket should reach a certain pre-arranged amount, and according to the counts, spinning and size and speed of the mule the total hanks turned off by a mule should approximate to a certain total.

Then a proportion is established as follows: If the total wages for such a total number of hanks be such an amount, what would be the price per 1,000?

Example.—It is estimated that a pair of mules are capable of producing 60,000 hanks of a certain yarn under fair average conditions, and it has been agreed on that the total wages of such mules for these hanks should be, say, £3 10s., what will be the price per 1,000 hanks?

$$60{,}000 : 1{,}000 : : 840 : ?$$
$$= 60 : 1 : : 840 : 14\text{d. answer.}$$

It is stipulated that the piecers shall receive a certain percentage of this amount. If a minder only produces, say, 56,000 hanks, then he will receive 4×14 pence less wages than the above estimated average, while, if he can produce more than 60,000

hanks, he receives so much more wages. Let it be noted that the principle is correct whether £3 10s., £5, or any other total wage forms the basis.

Labour charges for preparing and spinning either 32's, 60's or 100's twist, in 1900.

Taking a complete ring spinning and weaving establishment for the lower counts, an American writer gave the following table, from which an approximate idea of labour costs can be obtained, for that period :—

	Per cent.
Overseeing at	15·87
Picking	1·45
Carding	4·46
Drawing	2·68
Roving and spinning	18·52
Ring cleaners	0·58
Back boys	1·65
Doffers	2·45
Spooling	3·86
Warping	1·18
Web drawing	1·51
Slashing	0·83
Weaving	44·96
	100·00

By comparing the foregoing figures a good idea of the expense of any one department as compared with any other can readily be obtained. In Lancashire in 1920, the operatives' wages were temporarily increased from 100d. to 315d. owing to the boom following the armistice at its highest, then the increase was equal to 215 per cent.

Low Prices.

In some of the years preceding 1900 raw cotton and costs of production ruled very low. Take a case of low grade cotton at 3½d. per lb. Find warehouse cost ?

In a certain case which came under the present writer's notice of similar counts spun, part being frame and part mule, the total production cost per lb. of the yarn was 2·04 pence. Providing therefore that the cotton cost 3½d. per lb. delivered at the mill, the cost per lb. of yarn to the master spinner in his warehouse would be 5·54 pence, without allowing for conditioning discounts, yarn commission, and certain other contingencies. These figures were remarkably low.

In 1900 it could be taken that a good modern mill, spinning 32's twist American cotton, could produce a pound of yarn at

approximately $2\frac{1}{8}$d., with average circumstances, and without allowing for any profit.

There is comparatively little difference in England between the cost of production of the yarn, whether spun on the mule or ring frame, one circumstance balancing another.

Total labour cost (other than salaries) of 40's weft per 1,000 hanks in 1898.

The total amount paid in wages would probably approximate to something like twenty-two pence per 1,000 hanks, of which the spinner and his piecers would require something like 13·5 pence. This would leave about 8·5 pence per 1,000 hanks for the wages in the card and scutching rooms, and for overlooker's wages, the fly-frames taking the major portion of this 8·5 pence. All this, of course, is quite exclusive of what the yarn costs in the way of coal, depreciation and various expenses, which, all combined, would not be a great way from approximating to the total cost of the labour. It must be remembered that the data given can only be approximately correct, since quite a number of circumstances tend to give a variation in actual practice.

Indicator.

One of the most popular forms of indicator as used on fly-frames and ring-frames for registering the hanks of cotton passed through the front roller to each spindle is shown in Fig. 13, and is made by Messrs. Orme, of Oldham. There is a worm on the front roller, and this gives motion to a worm wheel.

The rotation of the wheel compels the forward movement of the dial numbers on the right hand. A complete revolution of these figures from 1 to 0 or 10 is followed by a forward movement of one number on the next dial, etc. The dials show hanks and decimal parts exactly as they are put down on paper. Thus the line, as shown, reads 99·9 hanks.

Example of Calculation Method.

Example designed to show principles of working cost of production.

1. Working backwards from the figures such as might be taken from the mill books at a periodical stock-taking.

Costings may be taken per spindle or per lb. of yarn spun, the latter being here given the preference.

A mill of 100,000 mule spindles has a production of 27 hanks per spindle of 30's yarn in a working week of 48 hours.

A full stock-taking is done at the end of six months.

It is found that the average price per lb. paid for the raw cotton had been 1s.

During the six months the amount received for waste totalled £1,000.

Waste loss averaged 13 per cent.

£1,400 allowed for depreciation.

5 per cent. added to the weight of yarn fresh from spindle point, by conditioning.

£2,000 paid for interest on loan money.

£2,000 paid for coal.

General expenses include accessories, repairs, stores, carriage, water, rents, taxes, lighting, discounts and commissions, and are taken at a total of £3,000.

Cost in wages taken at 2d. per lb. of yarn.

Items in above costings have varied so much of recent years that no item can be taken to agree accurately with mill practice at a particular time.

These considerations, however, exercise no effect on the principles and methods of total costing as herein applied.

The more fully the above items are split up, the more searching and informative will the thing become.

Wages for example could be split up into the departments of the mill.

Discounts, credits, and commissions could come under "selling expenses."

Solutions to Costing Calculation.

1. $$\frac{\text{Spindles. } 100000 \times \text{Weekly Hanks per Spindle. } 27 \times \text{Weeks in Half-year. } 26}{\text{30's counts}} =$$

2,340,000 lb. total of yarn in 26 weeks.

2. $$\frac{2340000 \times 100}{87} =$$

2,689,655 = lb. total of raw cotton to be purchased.

Every 100 lb. of raw cotton becomes reduced to 87 lb. of yarn produced.

The 13 per cent. waste allowance reduces weight of yarn produced.

3. Conditioning increases the weight for the market, in this case as 100 is to 105.

$$\frac{2340000 \times 105}{100} = 2{,}457{,}000 \text{ lb.} = \text{weight of packed yarn.}$$

4. It is obvious that the cost per lb. of yarn spun can be obtained by first dividing out the total depreciation loss, the total coal bill, and the total interest paid into so much per lb. of yarn spun or sold as the case may be.

Proceeding on these lines, somewhat searching detailed figures will be obtained.

The method adopted below is more on grouping lines.

Assembly of Costings.

	Totals in Pence.
1. Raw cotton at 1s. per lb. = £117,000 = 2,689,655 at 1s. . . . . =	32,275,860
2. Wages at 2d. per lb. = 2,340,000 × 2 . =	4,680,000
3. Loan interest of total £2,000 . . . =	480,000
4. Coal at a total of £2,000 . . . . =	480,000
5. Depreciation at a total of £1,400 . . =	336,000
6. General expenses at a total of £3,000 . =	720,000
Total mill costs in pence . .	38,971,860

There are two or three important items for cost reduction apart from the returns from yarn.

These include income from waste, from conditioning, and from sale of old materials. All these may be realised and deducted from the above total costs.

If a more searching report is required as to costs per lb. for discounts or commissions or other selling charges, they would be made on the weight of yarn sold—not on the weight fresh from spindles.

Waste equals difference between weights of raw cotton and spun yarn and is here assumed to equal 2d. per lb. over all. About 6d. per score of lb. for the lowest droppings, and 5d. per lb. for the best usable wastes represent wide variations.

Some of the 13 per cent. would be total loss due to invisible loss in cotton drying, and visible loss such as sand and seed.

Raw cotton	= 2,687,000 lb.
Spun yarn	= 2,340,000 ,,
Loss in waste =	347,000 ,,

347,000 at 2d. = 694,000 pence, income from waste.

Invisible loss in the earlier processes, and some due to cotton getting drier, possible conditioning of waste, and other mill possibilities affect the waste costing, and some would prefer to take the weights and prices of waste from the books at the six months' end, in the same way that depreciation, coal, and other totals are taken.

Conditioning.

2,457,000
2,340,000

117,000 lb. extra packed through conditioning.

Total pence charges for six months	=	34,776,000
Less pence received for waste	=	694,000
Reduced costs	=	34,082,000

This total is for 2,340,000 lb. of spun yarn or for 2,457,000 lb. of packed yarn, and we may calculate the cost per lb. on either or each of these two totals as desired. Take the higher:

$$\frac{34082000 \text{ pence}}{2457000 \text{ lb.}} =$$

13·83 pence per lb. as cost of production selling price for the yarn, above this 13·83 may be regarded as approximate profit.

A salesman or manager having established his cost of production in some such manner as above for certain counts, should be able to readily determine costs for other counts in his range, or to meet other altered conditions.

Effect of Raw Cotton Price on Cost of Production.

When raw cotton is dearer the money loss in waste is greater, although the actual per cent. or weight of waste remains unaltered.

Example 1.—A mill using good Egyptian cotton has an unsaleable waste loss, visible and invisible of 3 per cent. and uses 30,000 lb. of fresh cotton each week. When this kind of cotton was cheap, 1s. per lb. was paid for it, but in the 1920 boom reached 6s. or even more for some little time.

What does this unsaleable loss represent in a quarter or thirteen weeks?

(*a*) $\frac{30000 \times 97}{100} = 29{,}100$ lb.

(*b*) 30,000 − 29,100 = 900 lb. loss per week.

(*c*) 900 × 13 = 11,700 lb. loss per quarter from this source.

(*d*) 11,700 lb. loss at 1s. = £585 loss, and
11,700 lb at 6s. = £3,510 ,,

This total loss would be increased by the increased loss on every lb. of usable waste.

Against this, however, might be set increased returns from conditioning, which count strongly with prices ruling high.

Raw cotton purchased	100 lb.
Loss in waste	13 „
Yarn from spindle points . . .	87 „

Weight after 5 per cent. conditioning, when 100 lb. becomes 105.

$$\frac{87 \times 105}{100} = 91{\cdot}35 \text{ lb.}$$

So that for 91·35 lb. yarn sold 100 lb. of fresh cotton are required.

Production cost increased in this manner but reduced by amount received for usable waste or value of amount used in same mill. Such calculations become more complicated in comber mills and in mills producing both carded and combed yarns.

Carded and Combed Calculation for Waste.

(1) In a specific example it is ascertained that the total loss up to and including the carding engine equals 12 per cent. and the loss in the combing operations is 17 per cent.

(*a*) 100 lb. of fresh cotton becomes 88 lb. in card sliver.

(*b*) 88 lb. loses 17 per cent.

(2) If 100 lb. lose 17 what will 88 lose?

$$\frac{88 \times 17}{100} = 14{\cdot}96 \text{ lb. loss for combing.}$$

$$88 - 14{\cdot}96 = 73{\cdot}04 \text{ lb.}$$

(3) From comber to spun yarn the total waste is 4 per cent. inclusive,

$$\frac{73{\cdot}04 \times 4}{100} = 2{\cdot}92 \text{ lb.}$$

and $73{\cdot}04 - 2{\cdot}92 = 70{\cdot}12$ lb. of yarn from 100 lb. raw cotton. Conditioning will proportionately increase this weight.

For every 1 lb. of spun yarn there would need to be

$$100 \div 70{\cdot}12 = 1{\cdot}42 \text{ lb. of raw cotton,}$$

or very slightly less in proportion to the per cent. of conditioning.

There are yet mills—especially on American cotton—in which the range of counts is comparatively small, and the large calculation example previously given may be accurate enough to serve the purpose.

There are other mills spinning ranges, kinds, and counts of yarn varying so much that such generalisations would only be of moderate use.

For example, it is no uncommon thing for mills to contain both mule and ring spindles, to produce carded, semi-combed, and combed yarns ranging in counts from 30's to 100's or finer, and using very different values in raw cotton.

Calculations in such cases would need a primary division into ranges of yarns and preparations, keeping sufficient accounts separate for different sorts, wages, wastes, proportions of coal, interest depreciation, taxes and other charges allocating to the sections.

In cotton spinning mills the practical value of accurate costing —as distinct from the intrinsic and educational value—is somewhat diminished by ruling conditions in England.

For example, for certain numbers of cards, for certain sizes of fly-frames, or ring-frames, for 1,000 hanks or 100 lb. of yarn spun on the mule, operatives and employers have agreed to certain uniform rates. When a manager or salesman has conducted his costing calculations eminently well, he will still be largely ruled in selling, by what he can get at the time, because other firms are generally offering much the same yarns at the same time, and it becomes a question of who will sell the cheapest irrespective of production cost.

We have previously alluded to the spindle basis of calculations relating to cost.

Suppose from the mill books it is ascertained that the total wages for the week in a ring mill of 50,000 spindles, reaches £300.

The cost per spindle would obviously equal :—

$$72{,}000 \div 50{,}000 = 1{\cdot}44\text{d.}$$

Assume the total yarn production to equal 65,000, it is clearly easy to convert 1·44 to terms of 1 lb.

Suppose of the above £300 it was found from the books that £160 represented final spinning, and £140 total for all operations up to and including the roving or jack-frames. This process could be followed to the point of total wages paid for each complete preparation for each set of fly-frames, draw-frames or cards.

Included in working expenses may be : banding, belting, ropes, oil, tallow or other semi-solid lubricant, rents, rates, heating, lighting, insurance of mills, insurance of operatives for sickness, periods of unemployment, or accident risk, depreciation of buildings and machinery ; and other "on-costs" as distinct from wages.

In the section on "yarn transactions" terms of dealing are specified.

The Liverpool Cotton Association some years ago forced the abolition of discounts on raw cotton purchase, and repeated efforts have been made by spinners to abolish discounts on yarn, but without success so far.

The most used terms in England are $2\frac{1}{2}$ per cent. discount in

fourteen days, 3 per cent. prompt net cash plus 1 per cent. commission to agent or 1½ per cent. if a guaranteeing agent. Abolition of discounts would somewhat simplify accounting work.

Items.—Discounts, commissions, transport, and interest on long date accounts naturally add proportionately to cost of producing and marketing the yarns.

Business is often done very quickly on change, and good salesmen will be ready with any ready reference figures, formula and data previously established by experience or careful calculation.

Some spinners, especially some of the larger ones, carry on a large export trade, in which accurate costing is complicated by additional items especially if delivered to any foreign town. Such business, however, is largely done through agents who specialise for certain foreign markets.

1. Import duties are prevalent in most countries. They add to cost of yarn, and may have to be paid by the person who exports the yarn from England.

2. Freight, special packing or making up, transit insurance, payable by the spinner or exporter must be added to yarn price.

3. The credit of fourteen days for the home trade may be extended to forty-five days for some continental markets, and interest on the thirty-one days extra credit must be considered.

4. The Manchester discount of 2½ per cent. only becomes 2 per cent. for some foreign markets, which permits a slight reduction in yarn costing for foreign sales.

Returnable packing skips or boxes are used for the home trade, but for foreign trade the cost of transit, difficulty and time of getting skips or boxes returned, cause spinners to use light non-returnable cases which add to cost.

Glasgow for thread, Nottingham for lace and hosiery, Bradford for dress goods, have often longer credits.

Wages costings may be made for each mill department to any extent of subdivision required.

Elsewhere we give calculations relating to mule spinner's wages.

Indicators play an important part in determining the weekly wages of frame tenters, and mule spinners, and sometimes also of comber tenters.

Sometimes weekly wages are paid for both comber and fly-frame tenters depending primarily upon the size of machines.

Example of Indicator Payment.

A pair of intermediate frames of 140 spindles each produce 46 hanks per spindle per week all round. The rate of payment is 6d. per hank and she minds the pair of frames with adequate backtenting assistance separately paid from the office. The hank inter-

mediate is 3. Find total lb. produced and amount of tenter's wages. Also cost per lb. in chief tenter's wages.

(*a*) $\frac{140 \times 2 \times 46}{3} = 4{,}693\frac{1}{3}$ total lb. weight.

(*b*) $46 \times 2 = 92$ hanks.

Hanks paid for as the tenter is usually paid on what one spindle does on each frame unless a fixed weekly wage is paid.

(*c*) 92 × 6d. = 46s. wages
552 pence ÷ 4,693 lb. = ·1176 pence per lb.

Cost of production for tenter's wages.

These examples are simply given as indicative of how detailed costings may be ascertained to any degree desired.

Method of Calculating Discount and Agency Fees.

Yarn discount and agency fees are usually calculated on selling price of yarn.

For example take yarn sold at 2s. per lb. on any one of the usual discount terms of $2\frac{1}{2}$ per cent. direct fourteen days; 3 per cent. direct prompt cash; $3\frac{1}{2}$ per cent. ordinary agency; 4 per cent. through guaranteeing agency.

(*a*) $\frac{24 \times 2\frac{1}{2} \text{ per cent.}}{100} = \cdot 6\text{d. per lb.}$

(*b*) $\frac{24 \times 3 \text{ per cent.}}{100} = \cdot 720\text{d. per lb.}$

(*c*) $\frac{24 \times 3\frac{1}{2} \text{ per cent.}}{100} = \cdot 840\text{d.}$ „ „

(*d*) $\frac{24 \times 4 \text{ per cent.}}{100} = \cdot 960\text{d.}$ „ „

In each case this must be added to the cost per lb. of production before reckoning profit or loss.

The 1 per cent. commission for example would work out on 20,000 lb. of yarn at 2s. per lb., as follows:—

20,000 lb. at 2s. = £2,000.

Commission at 1 per cent. would be $\frac{1}{100}$ of this = £20 and $1\frac{1}{2}$ per cent. at £30.

Some have argued that the commission should only be calculated on the price of yarn after the $2\frac{1}{2}$ per cent. discount has been deducted. In above example this would mean that 20 × £2 10s.

= £50 would not be calculated upon in the commission, and the agent would receive 10s. less on the transaction. This method is seldom adopted.

Book-keeping would be simplified somewhat by stopping the $2\frac{1}{2}$ per cent. discount. High prices of yarns naturally mean better commission fees, and higher totals in discount than do low yarn prices.

Second Method of Finding Cost per Lb.

1. *Waste Loss.*—Waste loss 15 per cent., regain 5 per cent.

From 100 lb. of the raw cotton we spin 85 lb. of yarn.

5 per cent. conditioning 15d. per lb. for raw cotton on 85 lb. becomes :—

$$\frac{85 \times 5}{100} = 4{\cdot}25.$$

85
4·25
89·25

2. *Conditioning.*—For 89·25 lb. of yarn sent away we require 100 raw cotton :—

89·25)100·00(1·1204 lb. of raw cotton for 1 lb. of yarn sold.
8925
10750
8925
18250
17850
40000
35700

Note calculation is upon yarn sold and not from spindle point. For 15 per cent. combing loss, the loss in combing would be added to the 15 per cent. above.

So far as cotton waste loss only is concerned the price 15d. would be increased as below, allowing also for conditioning.

$$\frac{15 \times 1{\cdot}1204}{1} = \begin{array}{r} 1{\cdot}1204 \\ 15 \\ \hline 16{\cdot}8060 \end{array} \text{ pence.}$$

3. *Value for Waste Sold.*—Of the 15 per cent. waste loss we may take about 12 lb. as saleable and from the waste contract find the average price per lb. received. Take this at 3d. we get 3s. back for waste on every 89·25 lb. of yarn sent away.

36d. ÷ 89·25 = 89·25)36·0000(·403 pence per lb. returned.

35700
30000
26775

16·806 − ·403 = 16·403 cost per lb.

after allowing for waste loss and waste value received.

The financial loss due to waste is greater per lb. of yarn produced, the higher the cost per lb. of raw cotton. This is true even when we consider the higher amount obtained by conditioning.

4. *Wages.*—From the books it should be convenient to obtain the weekly production from any set of machines, such as fly-frames, or ring-frames for example; and also the amount paid in wages for that production.

Example.—The books show that £400 in wages were paid for producing 60,000 lb. of cotton up to any specified stage.

$$\frac{£400}{60000} = \frac{96000 \text{ pence}}{60000} = 1{\cdot}6 \text{ pence per lb. for wages.}$$

This principle may be either assembled to include any number of processes, or *per contra* subdivided by applying it to cards and blowing room only, or any one of the stages in drawings, slubbers, intermediate frames, rovers, or final spinning.

General expenses may include such items as rents, rates, taxes, depreciation, cost of banding, belting, oil, coal, repairs, lighting, buildings, salaries of chief officials. Separation of accounts and costings vary considerably with different spinning firms.

In cases of loan money it is necessary to account for this in the cost of running the concern, and even with all paid-up capital there are some who allow for interest on capital before reckoning business profits.

5. Assume the working expenses for a given period be £300 on a production of 250,000 lb. of yarn.

$$\frac{72000 \text{ pence}}{250000 \text{ lb.}} = {\cdot}288 \text{ pence per lb.}$$

Effect of Very High Priced Cottons.

With Egyptian cotton at 7s. 6d. per lb. and American cotton at 2s. 6d., prices which prevailed in the earlier months of 1920, waste losses increased greatly per lb. of yarn spun.

In the same way the shorter hours—48 instead of 55½—the increased operatives' wages—in many cases three times as high for the same amount of work—and vastly increased costs of leather,

coal, and all kinds of necessary or accessory articles, vastly altered all items in cost of production. Pre-war costs of production lost much of their value, excepting in first principles. It used to be the case about 1898, that 2½d. per lb. would cover everything but the raw cotton in spinning and marketing American 32's and double that amount for 60's Egyptian.

Before the war the costings appreciably increased. Since the war actual production costs have had little permanent value, excepting as illustrating principles and methods.

Increased Costings for Export.

Freight.—If needed it is possible to find freight rates to any point of delivery for specified weights of yarn, and from these it is easy to find cost per lb. of yarn.

Import Duty.—Printed lists are available for these, but war effects and results have disturbed these. Direct sales abroad must reckon foreign tariffs and rates of exchange in estimating costs and before estimating profit or loss.

Credit periods may reach two months or so for foreign orders, and discounts differ from the Manchester terms, and should be reckoned in costs of production, calculations for foreign orders.

Forwarding agents sometimes act for spinning firms in export business.

Hosiery Trade.

A good quantity of cotton yarn is absorbed in the hosiery trade, covering a wide range in counts and qualities of yarn.

It has been defined that the term hosiery has sometimes been taken to mean coverings for the feet and legs and maybe so yet with some people. In England at any rate, the term is often applied also to underwear and other knitted goods, as distinct from woven ones.

Hosiery underwear may refer to under-shirts, under-pants, under-vests, and generally to knitted garments, such as more usually are worn next to the skin. From moderate sorts of cotton yarn some hosiery mills produce large quantities of such articles as mutton-bags on the knitting system. Sometimes the term hose is applied to knitted stockings of full length, and the term half-hose to men's socks.

Costings about 1910.

There are innumerable circumstances of greater or less importance, from the purchase of the raw cotton, the building, financing, and starting of the spinning mill, to the sale and delivery of the

yarn, which affect the price of the yarn to a greater or less extent. The cotton trade is so well established, 60's yarn is so common an article and so much and regularly wanted, that a good idea of the cost of production may be formed even before a mill is started. Perhaps, however, the only way to get the exact cost of production for any particular mill is to wait over a period of a few months—say, six—and then determine from the mill books what the following items come to. Take a definite example prepared by a well-known mill manager. It was assumed that a mill of about 88,000 spindles could produce 32,200 lb. per week of 60's twist. From actual mill records it was found that per lb. of yarn produced there were the following expenses:—

	Pence.
Slubbing and drawing tenters in wages	·0913 per lb.
Intermediate tenters	·0640 ,,
Roving-frame tenters	·2337 ,,
Spinners' wages	1·2190 ,,
Day wages and salaries	·5318 ,,

The wage bill thus amounted to 2·1398 pence per lb.

Also from the mill books it was found that the trade expenses, including many items such as carriage, oil, loan interest, rates, gas and water, and roller covering, repairs, commissions, strapping and banding, and depreciation, amounted to 2·24 pence per lb. of yarn produced. The important items of waste and cellar gain have to be considered in addition to the foregoing, let alone manifold details of lesser importance.

In the case quoted the books showed a total waste loss of more than $18\frac{1}{4}$ per cent. and against this a cellar gain of $5\frac{3}{4}$ per cent. With the cotton cost of $7\frac{3}{4}$d. per lb., a statement was prepared and summarised somewhat as below: Cost of cotton, $7\frac{3}{4}$d. per lb., cost of taking the cotton through the mill 4·77d. per lb., assume now a mill is determined to have 8 per cent. or 5 per cent., or other profit, it would be added to the foregoing to get the selling price per lb. of yarn.

The exigencies of trade sometimes compel sales of yarn at much lower profits, or even at a loss, this being sometimes counter-balanced by extra profits being obtained on other yarns, or at other times. Starting with the raw cotton price at $9\frac{1}{4}$d. per lb., and the total cost of making the roving ready for the mules to be $3\frac{1}{4}$d. per lb. for general expenses and wages, we have then one or two important items to consider with regard to spinning costs. Spinners' wages, for example, vary somewhat per lb. of yarn produced, the above quoted statement giving 1·219 pence per lb. Naturally, to the roving cost must be added the spinning cost, and a proportion of sundry charges too numerous to mention. Warehousing, commissions on yarn sales, further loss in waste are debit items against the cost of

making the yarn. Cellar gain is a credit item. Suppose the yarn is for a foreign market, the special circumstances attending the sale and delivery of yarn to the other country need to be considered in fixing the yarn price. Take as a particular example the sale of 60's yarn to Germany. The fixed pre-war import duty some time ago was quoted at 1·18d. per lb., the through rate for transit 0·4d., insurance 0·05d. per lb., packing 0·14 per lb., giving a total of 1·77d. per lb., nearly all extra charge, as compared with local sales, besides having to wait longer for payment. Prior to the war, Lancashire exported a large amount of yarn to Germany and Austria. Items such as the foregoing would need consideration in fixing the price per lb. of the finished yarn.

Productions.—50,000 ring-frame spindles spinning 32's twist from American cotton with a spindle speed of 9,000 revolutions per minute. Assuming that the full production had to be made into warps at the same mill, find the number, and speeds, of the winding-frame spindles required.

For 32's twist from decent American cotton we might attain a spindle speed of 9,000 to 9,500 revolutions per minute, with $1\frac{5}{8}$ inch inside diameter of ring, 5 inch lift, 22·6 turns per inch, 1 inch diameter of front roller, allowing one minute per doffing, and two hours per week for cleaning and stoppages. Under such circumstances the production per week might reach something like 44 hanks per spindle, which equals 44 ÷ 32 lb. per spindle. These particulars are, of course, known to be possible from past experience, but local circumstances always affect particular cases, and frequently lower speeds and lower productions are in vogue in our mills, while the best of circumstances might witness increased productions. For 9,000 revolutions per minute of spindle the production may be taken at 42 hanks per spindle approximate. Therefore, we have

$$\frac{50000 \times 42}{32} = 65{,}625 \text{ lb.}$$

as the total production of the mill.

Taking the spindle speed of 9,000, and dividing this by the 22·6 twist per inch, we obtain the inches delivered per minute per spindle. From this it is self-evident how to calculate the hanks and lb. per spindle and per 50,000 spindles per week, for continuous running, and then deduct for stoppages as specified above.

In regard to the second part of the question relating to winding and warping, the vertical spindle winding-frame, making flanged bobbins, with or without barrel shaping, would probably be preferred in preparation for warping. The production depends upon number of spindles per winder, quality of yarn and ability of winder, and speed of spindle. For single yarns for warps it has been esti-

mated that a good winder might attend 60 spindles and wind 600 lb. of yarn in one full week.

$$600 \div 60 = 10 \text{ lb. per spindle.}$$

$$65{,}625 \div = 6{,}562 \text{ spindles}$$

as a complete full equipment for spindle winding the whole production. Again it must be remembered that local circumstances affect this kind of reckoning very considerably. There is, for example, a difference between winding from mule cops and from ring bobbins.

Recapitalisation.

The recapitalisation and refloating of spinning mills which sent Lancashire refloating mad in 1919-21, left some firms much worse placed than others in regard to mortgage, loan money, and bank over-drafts.

There were mills of 100,000 spindles owing £30,000 to the bank, but only having 10s. or 12s. per £1 share called up. When further calls were made later on many investors were unable to meet the calls.

In other cases all the £1 was paid up but there was very little loan money, bank overdraft, or other item on which a large interest charge must be paid.

The firm may allow for this interest before declaring profit or loss, or at least before paying a dividend, so in a sense this adds to cost of production, or at any rate, to the price estimated to be charged for the spun yarn before a selling price can be fixed that will give a profit. It was suggested by one manager during the trade depression that no firm should sell *below* its cost of production, but the idea was not adopted as an association law.

Standard yarns from good firms may vary so little that the cheapest sellers on the market, really fix the prices on any one day, irrespective of how much profit or loss any one firm may be faced with.

Cases arose in which certain spinning firms bought largely of cotton without covering with yarn sales or "futures," and then the price of raw cotton has gone up. Such firms have come on the yarn markets and cut prices below what almost any other firm can offer at. Needless to say a sharp fall in cotton and yarn prices would have worked out the other way.

Calculation Example.—A spinner buys a stock of cotton at 8¼d. per lb., and a second stock of better cotton at 12d. per lb. He requires a mixing of these two to equal 10,000 lb. weight, and wants it to cost 9¼d. per lb.

How many lb. weight of each sort must be used?

Solution 1.—

(*a*) 12d. – $9\frac{1}{2}$d. = $2\frac{1}{2}$d. loss on the 1s. cotton.
(*b*) $9\frac{1}{2}$d. – $8\frac{1}{4}$d. = $1\frac{1}{4}$d. gain „ $8\frac{1}{4}$d. „
(*c*) $2\frac{1}{2}$d. ÷ $1\frac{1}{4}$d. = 2d.

which implies 2 lb. of the cheaper to 1 lb. of the dearer cotton.

(*d*) $\frac{10000}{3}$ = $3,333\frac{1}{3}$ lb. at 12d.

and therefore $6,666\frac{2}{3}$ „ „ $8\frac{1}{4}$d.

Method 2.—

(*a*) At a price of 12d. the total 10,000 lb. would cost 120,000 pence.
„ „ $9\frac{1}{2}$d. „ „ „ „ 95,000 „
(*b*) The difference between above two totals = 25,000 „
(*c*) This difference divided by the difference in price will give weight of cheaper cotton required.

12d. – $8\frac{1}{4}$d. = $3\frac{3}{4}$d. and 25,000 ÷ $3\frac{3}{4}$d. = $6,666\frac{2}{3}$ lb. at $8\frac{1}{4}$d.
Therefore the 12d. cotton required = $3,333\frac{1}{3}$ „

10,000 „

Leading items in costing are: (1) Price per lb. of raw cotton: (2) salaries and commercial costs; (3) mill wages; (4) working expenses in such things as coal and accessories; (5) standing charges such as loan interest.

Commercial and selling expenses may include discount allowances, credit allowances in long date sales, agent's commissions.

"*Distribution of Overhead Costs.*"

(Mr. Ralph E. Loper in a recent paper in U.S.A.) *

"An equitable means of apportioning each item of overhead cost to the various divisions of the plant will be found in the appended tabulation:—

Typical Items.	Basis of Distribution.
Property taxes	Value of land, buildings, and machinery.
Interest on plant and equipment	Value of land, buildings, and machinery.
Depreciation	Value of buildings and machinery.
Fire insurance	Value of buildings and machinery.
Liability insurance . . .	Amount of pay roll.
Group insurance . . .	Amount of pay roll.
Boiler insurance . . .	Power consumption.
Flywheel insurance . . .	Power consumption.
Fuel and purchased power . .	Power consumption.

* See the final chapter.

Typical Items.	Basis of Distribution.
General supplies	* Records of supply consumption.
Repairs	* Records of repair work done.
Office and executive salaries	May be subdivided between material expense, selling expense, and miscellaneous expense.
Capital stock tax	Value of land, buildings, and machinery.
Interest on cotton	Material expense.
Interest on cloth	Selling expense.
Interest on supplies	* Records of supply consumption.
Interest on stock in process	Value of stock in process.
Interest on cash	Miscellaneous expense.
Licences, donations, etc.	Miscellaneous expense.
Legal expenses	Miscellaneous expense.
Use and occupancy insurance	Miscellaneous expense.
Office expenses	May be subdivided between material expense, selling expense, and miscellaneous expense.
Power charges	Redistributed on power consumption basis.
Repair shop charges	* Records of repair work done.
Material expense	Applied directly to raw materials cost.
Miscellaneous expense	Applied as a machine charge at the limiting department (usually spinning).
Brokerage and commission	Deducted from selling price.
Other selling expense	Applied directly to the product."

Monsoon Weakening.

An official telegram from India to the Secretary of State for India records :—

Rainfall—Scanty : Kashmir, Berar, Hyderabad, Madras (S.E.), and Madras Coast (North).

Fair : Bay Islands, Upper Burma, Assam, Bengal, Bihar, United Provinces of Agra and Oudh, East Rajputana, West Gujarat, Central India, West Bombay, Deccan, Mysore, and Madras Deccan.

Normal : Lower Burma, Punjab, and North Baluchistan and Central Provinces.

Excess elsewhere. Monsoon weakening. 25th August, 1922.

* Where records are not available recourse must be had to local knowledge of conditions, and experience in the treatment of this feature in other similar plants.

Production Costs, Winding and Gassing. No. 7. Winder.

This winder on :—

April	6,	was given	70	lb.	of 60's.
,,	13,	,, ,,	72	,,	,,
,,	20,	,, ,,	68	,,	,,
,,	27,	,, ,,	70	,,	,,
			280	lb.	

April	6,	booked up	68	lb.	of 2/60's.
,,	13,	,, ,,	70	,,	,,
,,	20,	,, ,,	66	,,	,,
,,	27,	,, ,,	66	,,	,,
			270	lb.	

The loss on this 60's yarn is very clear. Equally a separate account could be kept for each count of yarn and for each of the winders, so that a glance would help to show which kind of yarn and which winder were responsible for any undue amount of waste :—

$$\frac{100 \times 10}{280} = 3{\cdot}57 \text{ per cent. loss.}$$

If the winder is paid upon the yarn after doubling instead of before, she is not then paid for winding the waste. Proceeding upon similar lines the per cent. loss by waste could be ascertained for each particular department, such as drum winding, spindle winding, doubling, clearing, gassing, and reeling.

One of the items in regard to waste loss consists of cop bottoms in the case of starched bottoms and weight of tubes when the latter are used. Keeping the skewers bright and of the right shape and size for the cops, employing careful and skilful operatives, noting that the spinner keeps the cop bottoms and tubes in a satisfactory condition, wlll all tend towards reducing the waste and increasing the production. Partly because of the many fixed charges coming under the head of general or trade expenses, the greater the production of doubled yarn from a given number of doubling spindles, the smaller will be the cost of production per lb. Greater the range of single yarns bought and of doubled yarns produced, and more difficult will it be to accurately ascertain the productive cost per lb., and especially if the weights produced of each kind be comparatively small.

Adhering broadly to the three main divisions of waste, wages, and general expenses, statements may be prepared somewhat as

follows, remembering that we have to keep the "plain" yarns separate from the "gassed," and taking 90's single as a basis. Prices are taken simply as a basis. Bolton yarns from Egyptian cotton in weft counts, 60's average 16¾d.; 70's, 17¾d.; 80's, 19d.; 90's, 20¼d. per lb.

Plain Doubled Yarns 2/90's.

Single 90's cost	20¼d.	per lb. average.
General expenses as per books .	1·4d.	„ „
Cost of wages	2·4d.	„ „
Waste	·3d.	„ „

We thus get 4·1d. per lb. as cost of production. We take 20¼d. plus 4/1 plus profit to determine the selling price of the yarn.

Gassing is such a very special operation that many doublers fight shy of it, and it needs special attention in regard to amount of waste and cost of production. The waste is, of course, practically a dead loss since it results from burning away the loose projecting ends of fibres from the body of the yarn. It is important to determine the best counts of single yarn and the proportion of twist the yarn shall contain in order to produce in the most economical manner.

Gassed 2/90's.

Single yarn 84's cost	19·0
General expenses as per books . . .	1·8
Cost in wages	2·9
Loss by waste	1·3

We thus get 6·0d. per lb. as cost of production. As against this it may be said that we have a finer and higher priced doubled yarn due to the gassing.

It must not be thought that increasing the amount of production necessarily decreases the cost. For example, reduced clearing and winding speeds often give better qualities of work, so that the subsequent work of the doubler or the gasser is distinctly reduced, and there are fewer bad ends or other defects in the product. Possibly a softer twisted single yarn might be used with a lower speed, but such details require the careful attention of the mill officials. Above all, reduced speeds may lead to a reduction of the waste per cent., and it must be remembered that the fine doubled yarns often used for gassing have become very expensive before leaving the doubling mill. All the operatives in a doubling mill should be trained to keep the waste from the floor, as this naturally depreciates the value thereof. Approximate costs per lb.

of the different processes vary with different firms and with particular circumstances, such as number of hours worked. Quite a number of doubling firms appear to definitely cater for a section of their machinery to be worked all night as well as all day.

Wage and production indicators are constructed to allow of standard amounts of yarn or roving breakages. There are standard allowances for cleaning. Doffing times for almost any kind of machine are well tabulated. The modern cotton factory system is practically 150 years old and standardisation in mill practice has almost reached its limit, so that it is chiefly inexperienced theorists and educationists with little real knowledge of mill conditions, who talk glibly of impending great improvements and developments in the cotton trade, to come about in quick time.

Even the widths, lengths, and heights of mills, mill rooms, mill windows are well established, and the approximate number of spindles per mill.

Electricity is certainly moving strongly towards altering mill driving arrangements, as it is altering almost every other industry.

Loan Money.

The cotton industry is perhaps the most efficient and best organised in the British Isles.

Loan capital has played a very important part in mill building—especially for spinning mills in which large sums of money are wanted for one full-sized concern.

When profits have been reasonably good shareholders subscribing from $\frac{1}{5}$ to $\frac{3}{5}$ the total capital have benefited by using a large amount of loan money. With little or no profit the shareholders have suffered by having to pay a fixed rate of interest—above the mill profits for the time being.

The limited liability movement—starting with the Sun Mill in Oldham—has been the backbone of the spinning mill building in Lancashire for practically fifty years. It has enabled a group of small capitalists to combine their monies, with possible profits and losses proportioned to money subscribed; also a larger capitalist may take part to any extent desired in one or more concerns, and in each case his liability confined to his holding of shares.

The recapitalisations of 1919-21 reversed the position of many mills in regard to small proportion of share capital subscribed in relation to loan money.

Recapitalisation in many cases has given a larger proportion of share capital—called up and uncalled—and a proportionately smaller amount of loan money.

In some cases recapitalisation exceeded the bounds of prudence, and detrimentally affected many firms.

Motor Transport.

The gain to a cotton company in having its own motor transport instead of depending entirely upon the railways, is both direct and indirect at the time of writing.

The cost is much less, and the convenience for moderate distances, such as mostly obtain in the textile districts of Lancashire, is often very great.

A motor may take yarn from Oldham, Ashton or Bolton, to Blackburn or Burnley, and bring empty skips back, and do a return journey per day in every case, while for some of the shorter distances, a double return journey is little trouble.

At greater cost, railway transport has often been quite slow at delivery. Economic considerations will possibly lead to an improvement.

Cross country journeys—not very direct by rail—show motors to the best advantage, especially as country roads have generally been much improved for motor traffic.

In February, 1922, a leading paper quoted the following example.

A firm owns both spinning and weaving mills twenty-four miles apart.

Railway.

Cotton beam warps, 3 tons 5 cwt. made a load.			
(1) The railway rate of 35s. per ton would cost	£5	13	9
(2) Bringing cloth from weaving mill to Manchester, 3 tons at 24s. 10d. per ton. .	3	14	6
	£9	8	3

By Motor.

Motor expenses, including petrol, insurance, wages, licence, depreciation, etc. Including taking yarn to weaving mill and returning to Manchester with cloth same day	£3	18	0

Pre-war Costs of Production.

In 1906, operatives' leaders in Lancashire stated that a properly financed, equipped, and properly worked mill could produce 34's twist and 40's weft and make 2 per cent. profit with a margin of $2\frac{1}{8}$d. per lb. between raw cotton and finished yarn. American cotton with a margin of $2\frac{3}{8}$ inches the profit should reach 7 per cent. With

above $2\frac{3}{8}$d. margin it was claimed that operatives' wages should be increased by conciliation methods.

At this time two-fold twining might be done for $\frac{1}{3}$d. per lb., with combined reeling and bundling $\frac{3}{16}$d. or $\frac{1}{4}$d. per lb.

Raw cotton, coal, leather, mill accessories, were then cheap, railway and shipping charges were low, heavy motor transit almost unknown.

Higher priced cotton alone adds to production cost owing to heavier financial loss for waste.

1890 to 1912 it was deemed a near enough ready statement to say that the cost of production was about $2\frac{1}{4}$d. per lb. for 30's/32's American single roving, and $5\frac{1}{4}$d. for double roving 60's Egyptian. A little later these became 3d. and 6d. respectively.

1920-22 standing charges almost swallowed this much.

In 1909-10 the cost of production per lb. for 34's twist and 40's weft was $2\frac{1}{2}$d., with American cotton at 7d.

In 1919-20 all such costs as above began to look ridiculous for the time being.

Variation in Prices and Costing.

Here we only give the fundamental ideas and principles on cost of production in spinning mills.

War and post-war conditions completely upset all the actual costings which had become fairly well standardised in England before the war.

In some of the pre-war days a new mill of 100,000 spindles for producing carded yarns of 20's to 40's, could be built and fully equipped with machinery for about 21s. per spindle in Lancashire. Mill coal was then 6s. per ton in Lancashire.

The prices for 1918 to 1922 have been more like £5 per spindle.

Cotton operatives wages representing £100 pre-war, became £315 for the beginning of 1921. In December, 1922, it was about £190.

American cotton which was 6d. per lb. pre-war, and Egyptian cotton which was 12d. pre-war, rose towards the end of 1920 to 2s. 6d. and 7s. respectively. Road, railway, and shipping charges increased enormously.

Leather, coal, empty bobbins, skewers and most mill accessories showed an equivalent variation.

Hours of labour officially reduced from $55\frac{1}{2}$ to 48 per week.

Since the early part of 1921 some of these charges have been receding, and appear likely to continue doing so.

Fixed costs therefore cannot be put on a permanent basis. Pre-war calculation figures relating to yarn costs are all off.

Fundamental principles, however, remain much the same. Many years ago the author established a method of calculating production costs, as exemplified in previous pages.

Effect of Twist on Cost

Generally speaking, increasing the twist per inch put into the cotton, at any fly-frame, mule or ring-frame, irrespective of other considerations, increases the cost of production at the machines affected.

At a fly-frame or ring-frame (and often at the mule), the usual method of increasing twist is to diminish the R.P.M. of the rollers and thus diminish production and increase cost per lb. Such variations occur roughly as per the direct increases in twist or per the square roots of counts.

The Cost per Lb. Method.

Cotton is bought and yarn is sold at so much per lb. weight; hence the lb. costing basis.

The alternative method of costing everything at so much per mule or ring spindle is scarcely so logical or sound.

Either method can be adopted provided the required data is available from the mill books, as it will be in any mill having a reasonably thorough system of book-keeping and entering items up through the mill.

If coal costs so much in six months in a mill of 100,000 spindles, it is obviously easy to calculate the cost per spindle.

If also the total yarn production for the six months is known, it is equally easy to find the cost of coal per lb. of yarn. The same principle underlies costing for other items.

In some cases of costing and dividend reckoning interest is allowed on loan money only. Some masters or shareholders, however, claim that interest should be allowed on all the capital before counting dividend. On this basis an employer with £20,000 in a spinning mill would calculate interest on the £20,000 at the rate he would expect in any ordinary safe loan investment, before he reckons his profits from the business risks he takes.

A higher price per lb. for raw cotton, increasing the twist per inch put in the yarn, longer dates for yarn payments, converting the yarn from mule cop or ring—bobbin form—all add to the selling price that should be got for the yarn.

CHAPTER VIII.

WAGES IN SPINNING MILLS.

The rules and regulations in regard to wages and conditions of work in the various departments of a cotton spinning mill, have been formulated and administered with remarkable skill and exactness of detail for very many years.

The secretaries and chief officials of employers' and operatives' associations have displayed the utmost skill and honesty of purpose in arranging disputed points without bringing mills to a standstill.

In the Bolton province this feature is so marked that in a period of twenty-five years, up to the time of writing, only once or twice has a mill been brought to a standstill through a local or individual dispute, as distinct general differences, or matters over which the local officials have had little control.

The conditions and rules are very comprehensive and very full tables are published, and the selection given in this chapter has been carefully made with a view to bringing forward the more fundamental matters.

It is perhaps unfortunate that many comparatively small districts have lists of their own, but only the two chief ones of Oldham and Bolton are dealt with here.

Amalgamated Operative Spinners' Secretarial Examination, 1917.

The official price lists of operative spinners often involve questions and calculations of a very special, delicate, and complicated nature, requiring a knowledge of various conditions peculiar to the work.

The nature of the work has been well illustrated by the various examinations held in connection with the appointment of a secretary for one or another of the Spinners' Associations. One or two such papers have been dealt with in other publications by the present author, such as, "Thornley's Spinning Calculations" and volume II. "Mule Spinning."

A later paper given in 1917 is partially reprinted below, with most of the calculation answers.

Following this 1917 examination, Mr. Henry Boothman, of Oldham, was appointed secretary and headed the examination returns with Mr. Wm. Wood, of Bolton, a close second.

The general examination included dictation, composition, shorthand, letter-writing, speech-making and oral questions.

The calculations are reprinted below with solutions to all but the last one which is a matter of book-keeping.

All the questions are printed first, and then all the answers.

Messrs. Blackburn & Mather have helped considerably in the work of this chapter.

Calculations, 15th *May*, 1917.

1. A spinner employed on a pair of 66 doz. mules of 2 inches gauge receives 23·5d. per 1,000 hanks. He is spinning 24's twist, with 50 speed wheel and 14 inches rim with three grooves. The draw is 62 inches, which is the length per draw registered by the indicators, and the breakage is $\frac{1}{4}$ per cent. below the recognised breakage allowed by the Oldham list and conditions by which the spinner is paid. The yarn is spun from single rovings. The mules run three draws in 42 seconds, are fitted with double guides for the rovings, and the front roller, which is $1\frac{1}{16}$ inch diameter, makes $1\frac{1}{8}$ revolutions during the run in of the mule carriage. The mules produce $13\frac{1}{2}$ doffings per week from each mule, and to ensure good work both mules are stopped each time when doffing. The price paid is supposed to be present rates, and the full week is $56\frac{1}{2}$ hours, with an allowance off of $2\frac{1}{2}$ hours for cleaning, etc. How much is the spinner under- or over-paid? What hanks per week should the indicators register? What price should he receive, and what should be the gross wages for the pair of mules at present rates? What is the scale per tooth for a range of wheels from 40 to 60 speed wheel, and at what wheel does the scale change?

Five seconds per draw is allowed for backing-off and running-in of the mules.

The list wages for 77 doz. mules on standard rates without any allowances for quick speeds, etc., is £2 19s. 4d. which increases at the rate of 2d. per doz. spindles per pair up to and including 84 doz.

Quick speed allowances at standard rates are as follows:

87 doz. to 80 doz. inclusive: $7\frac{1}{4}$d. per second.
Below 80 doz. to 76 doz. inclusive: 7d. per second.
Below 76 doz. to 72 doz. inclusive: $6\frac{3}{4}$d. per second.

A maximum of 50 marks will be allowed for the above problem.

2. To convenience a customer an employer takes an order for some 40's pin cops spun weft-way, from single rovings. Half the order to be spun on $1\frac{1}{2}$ inch tubes and the other half on through

tubes. He gives instructions to a spinner on a pair of twist mules to spin them. This spinner is spinning 40's twist on a pair of 90 doz. mules, from single rovings at 16·859d. per 1,000 hanks, and his gross wage at present rates is 85s. 5d. His mules run at three draws in 43 seconds both for the twist and the pin cops. Doffings per mule are six on the twist and twenty on the weft. The full working week is 56½ hours, less 1½ hours for cleaning and accidental stoppages.

No tuber is provided. Tube barrels are provided for the short tubes, and the through tubes are put on by hand. The little piecer fills the barrels for one mule in 20 minutes. When using through tubes he is occupied for 25 minutes each doffing per mule preparing the tubes for doffing; 20 minutes per week are lost on both mules cleaning waste off the spindles.

It takes 12 minutes per mule per doffing to doff and tube on the short tubes, and 30 minutes to doff and tube one mule, when using through tubes.

Payment for tubing is at so much per mule per doffing with both kinds of tubes.

How much per 1,000 hanks should be added to the twist price so as to pay the spinner correctly for spinning the weft, leaving out of question the tubes. The spinner is paid according to the Oldham list and conditions?

What will be the price per doffing per mule for the short tubes, and also for the through tubes?

The little piecer's wage is 18s. per week (war-time).

What special change will the spinner make in carrying out his instructions, and what payment will he require for it according to the list and conditions?

3. A pair of Platt's mules are working with a 64 speed wheel, 96 drag wheel, 44 drag pinion, 49 twist wheel going twice round per draw, and a 1 inch front roller. The twist wheel is worked by a worm on the front end of the rim-shaft and has a 20/40 carrier.

The slippage in the rim band between the rim, which is 15 inches, and the tin roller pulley, which is 10 inches, is 5 per cent.

The employer has the front roller altered from 1 inch diameter to 1⅛ inch diameter, the drag pinion changed to 42, and the twisting motion arranged to work from the tin roller shaft through a 15/45 carrier.

What twist wheel will be required to meet the changed conditions, also what speed and drag wheels will be required after the alterations are completed, so as to maintain approximately the same twist, delivery, and carriage speed.

Backing-off and running-up occupies 6 seconds per draw.

A maximum of 40 marks will be allowed for this problem.

4. If 116's counts are being spun and 31·142 turns per inch are

being put in the yarn each stretch, show by calculation what twist wheel is in use, assuming that the twist wheel goes round 3·4 times per draw and the spindles revolve 11·673 times to one revolution of a 16½ inch rim, a 15½ inch rim being actually in use, and 62¼ inches of yarn put on the spindle every stretch. Also show how much the turns per inch being put in are below the standard turns per inch, assuming the latter are calculated by multiplying the square root of the counts by the multiplier for Egyptian weft, in accordance with the Bolton list, and what twist wheel, taking nearest whole figures, would be required to be in use if standard turns per inch were required? Calculations to be worked to three places of decimals.

A maximum of 50 marks will be allowed for this problem.

5. A pair of mules working 55½ hours per week, less 2¼ hours for cleaning time, 2½ per cent. for breakages, and 4 per cent. for invisible loss, and running 3 stretches in 49 seconds, including 5½ seconds for backing off and winding each stretch, with 1,130 spindles per mule, and producing 820 lb. of yarn per week when spinning 64's counts, what is the length of yarn put on the cop each stretch, and what number of stretches are done per week? Prove the number of stretches by calculating the lb. weight done from them, as above. Answers to be given in the nearest whole numbers.

A maximum of 45 marks will be allowed for this problem.

6. I wish to ascertain the weight of a set of cops numbering 1,168, and I take 5 of them to be weighed, and discover they are 11 ounces, 6 dwts., and 4 grains. What will be the weight of the whole set, stated in lb., ounces, dwts., and grains? If on testing the wrappings 6 leas weigh 3 dwts. and 4·923 grains, what will be the counts?

Write out the tables of weights and measures used for cotton yarns.

A maximum of 45 marks allowed for this problem.

7. An indicator is working with the following figures stamped upon the case—1,092, ⅔, 7, 17, 48, 66·5; and 20,000 hanks are registered on the dial. 1¼ per cent. breakage is allowed, so how much should the spinner be paid extra on a production of 62,000 hanks, the price for which is 1s. 8¾d. per thousand hanks, if the indicator is shown to allow more than the stipulated breakage, and what are the gross wages to be paid?

40 marks possible maximum for this question.

8. A pair of Asa Lee's mules, 100 doz. spindles, have the following particulars: rim 18 inches, front roller wheel 48 teeth, tin roller pulley 12 inches, counts 48's weft, revolutions of front roller wheel 21, front roller bevel wheel 24 teeth, rim pinion 21 teeth, spindle wharve ¾ inch, tin roller 6 inches, speed wheel 72 teeth, stretch 67½ inches. What are the turns per inch to two places of decimals, after allowing 5 per cent. for slippage of bands? Extract

the square root of the counts and turns per inch, and multiply them together. State also what are the standard turns for these counts in American yarns.

A maximum of 45 marks will be allowed for this problem.

9. From the following particulars ascertain the turns per inch and prices per 1,000 hanks to be paid for spinning the under-mentioned counts of yarns :—

Counts.	Speed Wheel.
34's weft	66
36's ,,	68
38's ,,	70
40's ,,	73
42's ,,	75
44's ,,	77

The constant is ·3509 multiplied by speed wheel. The basis price per 1,000 hanks is 13·5d. for 22·5 turns per inch, and to all the prices must be added 30 per cent., together with $1\frac{1}{2}$d. per 1,000 for tubing. For every additional ·2 (or fractional part thereof) of turns per inch, add $\frac{1}{10}$ of a penny.

A maximum of 40 marks will be allowed for this problem.

10. Make out a cash statement, properly balanced, from the following particulars of receipts and payments, showing whether there is a gain or loss on the quarter, and how much : 3rd April, 1917, Dispute Pay, £293 16s. 4d.; 22nd February, Bank Deposits, £2,313 11s. 9d.; 3rd February, Interest on Investments, £981 14s. 4d.; Loan repaid by Salford Corporation, £2,000 0s. 0d.; 10th March, Lockout Pay £831 15s. 7d.; 14th April, Levies to Labour Party, £416 5s. 0d.; 3rd March, Levies received, £5,432 9s. 6d.; Loan to Bolton Corporation £2,500 0s. 0d.; 1st February, Cash in Secretary's hands, £213 2s. 0d.; same date paid for Permanent Accidents £150; Deputations, £63 4s. 4d.; 3rd March, Permanent Accident Grant returned, £50; 16th April, Withdrawn from Bank, £177 13s. 10d.; 23rd March, Left-out Pay, £914 2s. 0d.; 30th April, Books and Papers, £3 4s. 0d.; One Quarter's Rent, £25 0s. 0d. 9th February, Received for Emblems, £7 10s. 0d.; 21st April, Subscriptions to Trades Union Congress, £35 10s. 0d.

A maximum of 45 marks will be allowed for this problem.

Answers to Foregoing 1917 *Secretaryship Questions.*

1. 66 doz. 2 in. guage $= \frac{66 \times 2}{1\frac{3}{8}} = 96$ doz. of $1\frac{3}{8}$ in. guage.

$96 - 66 = \frac{30}{2} = 15$ doz. diff. $\quad 66 + 15 = 81$ doz. spindles.

Net time = 56½ hrs. − 2½ = 54. Minus 13½ doffings (27 × 6 as per list) = 3,240 minus 162 = 3,078 mins.

$$\text{Breakage } \frac{3078 \times 97{\cdot}25}{100} = 2{,}993 \text{ mins.}$$

Hanks per week

$$= \frac{2993 \times 60 \times 81 \text{ doz.} \times 12 \times 2 \times 3 \times 62 \text{ in.}}{36 \times 840 \qquad 42} = 51{,}125 \text{ Ans.}$$

Price per 1,000 hanks = List wage 81 doz.	£3	0	0
Double roving guides	0	1	0
24's counts, clause 5	0	1	0
Quick speed = 7·33 sec. at 7¼d.	0	4	5
Roller motion = 2·4 sec. at 7¼d.	0	1	5
Standard rate	£3	7	10

$$\text{Quick speed} = \frac{63}{62} \times 42 = 42{\cdot}67 \text{ for 63 in. stretch}$$

$$= 50 - 42{\cdot}67 = 7{\cdot}33 \text{ sec. at } 7\tfrac{1}{4}\text{d. per sec.}$$

$$\text{Roller motion} = \frac{17}{16} \times \frac{22}{7} \times \frac{9}{8} = 3{\cdot}75 \text{ in.}$$

$$62 + 3{\cdot}75 - 65{\cdot}75 = \frac{62}{65{\cdot}75} \times \frac{42}{1} = 39{\cdot}6 \text{ sec.}$$

$$= 42 - 39{\cdot}6 = 2{\cdot}4 \text{ sec. at } 7\tfrac{1}{4}\text{d. per sec.}$$

$$\text{Present rates} = 25 \text{ per cent. £3 7s. 10d.} = 814\text{d.} = \frac{814 \times 125}{100}$$

$$= 1{,}017\text{d.} = £4\ 4\text{s. } 9\text{d. gross wage.}$$

$$\therefore \text{ Price per 1,000 hank present rates} = \frac{1017}{51{\cdot}125} = 21{\cdot}06\text{d. per 1,000 hanks.}$$

Amount overpaid = 23·5 − 21·06 = 2·44d. per 1,000 hanks.

Gross wages = 21·06 × 51·125 = 1076·69d. = £5 9s. 9d.

Scale per tooth (see notes) 62 at 3 in 42 = 63 at 3 in 42·67 sec.

$$= 42{\cdot}67 - 15 = 27{\cdot}67 \text{ secs. to draw out.}$$

Then if 50's W. gives 27·67 secs., the wheel where the scale changes will be

$$44 - 15 = 29 \text{ sec.} = \frac{29 \times 50}{27{\cdot}67} = 52\text{'s W.}$$

Price for 40's W. = 50's W. gives 27·67, 40's gives $\frac{40 \times 27{\cdot}67}{50}$

= 22·13 sec.

= 22·13 + 15 = 37·13 for 63 in. stretch.

then for 62 in. stretch $\frac{37{\cdot}13 \times 62}{63}$ = 36·54 secs.

Price for 40's W. = $\frac{36{\cdot}54}{42} \times 21{\cdot}06$ = 18·32d. per 1,000 hanks,

diff. = 21·06 − 18·32 = 2·74d. for 10 teeth

∴ Price per tooth = $\frac{2{\cdot}74}{10 \times 2}$ = ·13d. per tooth for quick speed + ·26 slow speed.

Conclusion

Amt. overpaid per 1,000 hanks . .	2·44d.
Cal. hanks per weeks	51,125
Gross wages.	£4 9s. 9d.
Scale per tooth, quick speed .	·13 per tooth.
Scale per tooth, slow speed . .	·26 per tooth.
Wheel where scale changes . .	52's W.

Answer to No. 2.

2. (*a*) Net time worked on 40's twist = 56·5 hrs. − 1½ = 55 hrs. × 60 = 3,300 mins.
less 6 doffings at 7 mins. per doffing, as per list = 42 ,,
3,258 ,,

No. of hks. produced on 40's t. = 85/5 = 1,025d.

Price per 1,000 hanks = 16·859 ∴ $\frac{1{,}025}{16{\cdot}859}$ = 60,798 hks.

Net time worked on 40's W. P.C. = 56·5 − 1½ = 55 hrs. × 60 = 3,300 mins.
Time lost on short tubes = 20 doffs. × 12 mins. = 240 mins.
Time lost on cleaning waste off spindles = 20 ,,
Total time lost . . . . . 260 ,,

Net time lost on mule using short tubes = 3,300 − 260 = 3,040 mins.
Time lost on through tubes = 20 doz. × 30 = 600 mins.
Time lost on cleaning waste off spindles = 20 ,,
Total time lost . . . . . 620 ,,

∴ Net time worked on mule using through tubes = 3,300 − 620 = 2,680 mins.

Average time worked on both mules $= \frac{3040 + 2680}{2} = 2{,}860$ mins.

Hanks produced in 2,860 mins. $= \frac{60798 \times 2860}{3258} = 53{,}370$ hks.

According to Oldham list and conditions 1s. must be added for spinning pin cops ∴ the gross wage = 1,025 + 12 = 1,037d.

Then the price per 1,000 hks. $= \frac{1037}{53{\cdot}370} = 19{\cdot}43$d. per 1,000 hks.

∴ Amount to be added to twist price = 19·43 – 16·859

Ans. 2·571 to be added.

(*b*) Price per doffing per mule =

Gross wage = 1,037d. mins. worked

2 mules = 5,720 mins.

Then price for short tubes $= \frac{1037 \times 12}{5720} = 2{\cdot}175$d. Ans.

Then price for long tubes $= \frac{1037 \times 30}{5720} = 5{\cdot}438$. Ans.

(*c*) The special change is turning bands, payment for which is at the rate of 1s. for 36 doz. spindles at $\frac{1}{2}$d. per doz. per pair upwards, then price for 90 doz. = 90 – 36 = 54.

54 doz. at $\frac{1}{2}$d. per doz. = 27d. + 1s. = 3s 3d. Ans.

Answer to No. 3.

3. (*a*) Twist wheel $= 49 \times 2 \times \frac{40}{20} =$ 196 revs. of rim shaft per draw.

$196 \times \frac{15}{10} \times \frac{95}{100} = 279{\cdot}3$ revs. of cyl. shaft.

$279{\cdot}3 \times \frac{15}{45} = \underline{93{\cdot}1}$ twist wheel required.

(*b*) Speed wheel $= 64 \times \frac{17}{16} = 68$ speed wheel required.

(*c*) Drag wheel $= 96 \times \frac{42}{44} \times \frac{16}{17} = 86{\cdot}2$ gain wheel required.

Answer to No. 4.

4. (*a*) Revs. of spindles per draw

$$= 31{\cdot}142 \times 62{\cdot}25 = 1938{\cdot}5895.$$

Revs. of spindles to one of $15\frac{1}{2}$ inches rim

$$= \frac{11{\cdot}673 \times 15{\cdot}5}{16{\cdot}5} = 10{\cdot}965.$$

Rev. of rim shaft per draw

$$= \frac{1938{\cdot}5895}{10{\cdot}965} = 176{\cdot}797.$$

$\therefore$ Twist wheel required $= \dfrac{176{\cdot}797}{3{\cdot}4} =$ 52's twist wheel.

(*b*) Standard turns per inch

$$= \sqrt{116} + 3{\cdot}183 = 10{\cdot}77 \times 3{\cdot}183 = 34{\cdot}28.$$

Turns per inch under twist

$$= 34{\cdot}28 - 31{\cdot}142 = 3{\cdot}183 \text{ turns.}$$

(*c*) Twist wheel for standard turns

$$= \frac{34{\cdot}28 \times 62{\cdot}25}{3{\cdot}4 \times 10{\cdot}965} = 57 \text{ twist wheel.}$$

Answer to No. 5.

5. (*a*) Net time worked

$= 55{\cdot}5 - 2\frac{1}{4} = 53{\cdot}25$ hrs.

$= 53{\cdot}25 - (2\frac{1}{2}$ per cent. $+ 4$ per cent.$) = 53{\cdot}25 - 6\frac{1}{2}$ per cent.

$$= \frac{53{\cdot}25 \times 6{\cdot}5}{100}$$

$$= \frac{53{\cdot}25 \times 6{\cdot}5}{100} = 3{\cdot}46125 = 49{\cdot}78875 \text{ hrs. worked.}$$

$$\text{No. of draws} = \frac{49{\cdot}78875 \times 60 \times 60 \times 3}{49} = 10973{\cdot}8 \text{ per mule.}$$

Total draws $= 10973{\cdot}8 \times 2 = 21947{\cdot}6$. Ans.

(*b*) Length of stretch

$$\frac{820 \times 64 \times 36 \times 840}{21947{\cdot}6 \times 1130} = 63{\cdot}989 \text{ inches.}$$ Ans.

(*c*) Proof of number of stretches

$$= \frac{21947{\cdot}6 \times 1130 \times 63{\cdot}989}{64 \times 36 \times 840} = \underline{819{\cdot}999 \text{ lb.}} \text{ Ans.}$$

Answers in nearest whole numbers.

(*a*) 21,948 draws.
(*b*) 63·989 inches, length of stretch.
(*c*) 820 lb.

Answer to No. 6.

6. (*a*) Weight of set containing 1168 cops.
5 cops weigh 11 oz. 6 dwts. 4 grains.
Weight in grains of 5 cops = 437·5 × 11
Plus 6 dwts. 4 grains.
∴ Total grains = 1,158,772·8 grains in 1,168 cops.
This ÷ 7,000 = 165 lb. 11 dwts. 8·8 grains. Ans.

(*b*) Counts = 6 leas weigh 3 dwts. 4·923 grains = 76·923 grains.

$$\text{Counts} = \frac{7000 \times 6}{7} \times \frac{1}{76{\cdot}923} = \underline{78\text{'s counts.}} \quad \text{Ans.}$$

(*c*) Tables of weights are ·24 grains = 1 dwt.
437½ ,, = 18·23 ,, = 1 oz.
7,000 ,, = 291·66 ,, = 16 ,,
= 1 lb.

(*d*) Tables of measures are :—

54 inches = 1 thread or circumference of wrap reel.
4,320 ,, = 80 threads = 1 lea.
30,240 ,, = 560 ,, = 7 leas = 840 yards = 1 hank.

Answer to No. 7.

7. Calculated hanks

$$= 1{,}092 \times \frac{3}{2} \times \frac{7 \times 17 \times 48 \times 66{\cdot}5}{36 \times 840} = 20575{\cdot}1 \text{ hanks.}$$

Price per cent. and breakage

$$= 20{,}575 - 20{,}000 = \frac{575}{20575} = \underline{2{\cdot}79 \text{ per cent.}}$$

Excess breakage = 2·79 − 1·25 = 1·54 per cent.

Price per 1,000 hanks, allowing for excess breakage

$$= \frac{20{\cdot}75 \times 101{\cdot}54}{100} = 21{\cdot}0695\text{d.}$$

NOTE.—Breakage has been taken at $1\frac{1}{4}$ standard in Bolton, but $2\frac{1}{2}$ was in vogue many years ago in Oldham.

Difference in two prices

$$= 21{\cdot}0695 - 20{\cdot}75 = {\cdot}3195\text{d. per 1,000 hanks.}$$

∴ Amount spinner should be paid extra on production of 62,000 hanks $= {\cdot}3195 \times 62 = 19{\cdot}8\text{d.}$, say 1s. 8d. Ans.

Gross wages

$$= \frac{21{\cdot}0695 \times 62000}{1000} = 1306{\cdot}3\text{d.} = \text{£5 8s. 10d. Ans.}$$

Answer to No. 8.

8. (*a*) Turns of spindle to one of rim

$$= \frac{18}{12} \times \frac{{\cdot}6 \times 4}{3} \times \frac{95}{100} = 11{\cdot}4 \text{ turns.}$$

Revs. of rim per draw

$$= \frac{21 \times 48 \times 72}{24 \times 21} = 144 \text{ revs.}$$

Revs. of spindles per draw

$$= 144 \times 11{\cdot}4 = 1641{\cdot}6 \text{ revs.}$$

∴ Turns per inch

$$= \frac{1641{\cdot}6}{67{\cdot}5} = 24{\cdot}32 \text{ per inch. Ans.}$$

(*b*) Square root of counts × turns per inch

$$= 6{\cdot}92 \times 4{\cdot}93 = 34{\cdot}1156\text{. Ans.}$$

(*c*) Standard turns for American weft yarns

$$= \sqrt{48\text{'s}} \times 3{\cdot}25 = 6{\cdot}92 \times 3{\cdot}25 = 22{\cdot}49\text{. Ans.}$$

Answer to No. 9.

	Counts.	Speed Wheels.	Turns per Inch.
9. (*a*)	34's	66	66 × ·3509 = 23·5
	36's	68	68 × ·3509 = 23·85
	38's	70	70 × ·3509 = 24·56
	40's	73	73 × ·3509 = 25·61
	42's	75	75 × ·3509 = 26·31
	44's	77	77 × ·3509 = 27·01

(*b*) *Prices per* 1,000 *Hanks.*

34's = 23·15 T.P.I.
22·50
·2)·65
·3 + 1 = 4
= $\frac{4}{10}$d. to be added.

13·5
·4
13·9
·3 = 3 per cent.
4·17
13·90
18·07
1·50 Tubing
19·57d. per 1,000 hanks.

36's = 23·85 T.P.I.
22·50
·2)1·35
·6 + 1 = $\frac{7}{10}$d

= 13·5
·7
14·2
·3
4·26
14·2
18·46
1·5
19·96 per 1,000 hanks.

38's = 24·56 T.P.I.
22·5
·2)2·06
·10 + 1 = $\frac{11}{10}$d.

= 13·5
1·1
14·6
·3
4·38
14·6
18·98
1·5
20·48d. per 1,000 hanks.

40's = 25·61 T.P.I.
22·5
·2)3·11
·15 + 1 = $\frac{16}{10}$d. to be added.

= 13·5
1·6
15·1
·3
4·53
15·1
19·63
1·50
21·13d. per 1,000 hanks.

42's = 26·31 T.P.I.
22·50
·2)3·81
·19 + 1 = $\frac{20}{10}$d.

= 13·5
2·0
15·5
·3
4·65
15 50
20·15
1·50
21·65d. per 1,000 hanks.

44's = 27·01 T.P.I.
22·50
·2)4·51
·27 + 1 = $\frac{28}{10}$d. to be added.

= 13·5
2·8
16·3
·3
4·89
16·3
21·19
1·5
22·69d. per 1,000 hanks.

Bolton and District Lists of Prices for Operative Spinners.

CLAUSE I.—TWIST STANDARD.*

Section 1.—The twist standard price is 21·78d. per 1,000 hanks of 50's count, with 25·5 revolutions of the spindles per inch of yarn, on mules of 420 spindles each. The prices have been brought out net, by deducting ½ per cent. for every additional 12 spindles beyond 420, up to and including 806 spindles, when spinning twist, reeled yarn, doubling, or pin cop weft counts on twist mules. Where, however, the number of spindles do not exceed 804 each mule, an extra 5 per cent. is allowed, and has been added for short mules.

Section 2.—Mules of 1¼ inch gauge or over to be considered *twist* mules, and to discount only for number of spindles up to 806 each mule. Larger mules of *twist* gauge to be paid the same price per 100 lb.

Section 3.—All counts below 32's twist to be paid the same price per 1,000 hanks; but in working out the price per 100 lb., hank by the actual count (even) spun.

Section 4.—Counts, whether twist, reeled yarn, doubling, or pin cop weft spun on mules of 1¼ inch gauge or over, to be discounted for length of mules up to 806 spindles only.

Section 5.—An additional 5 per cent. to be allowed when spining pin cops on mules over 1¼ inch gauge.

CLAUSE II.—REELED YARN STANDARD.

Section 1.—The reeled yarn standard price is 20·51d. per 1,000 hanks of 50's count, with 24 revolutions of the spindles per inch of yarn, on mules 420 spindles each; a ½ per cent. is deducted for every additional 12 spindles beyond 420 up to and including 806 spindles. Where, however, the number of spindles do not exceed 804 each mule, an extra 5 per cent. is allowed and has been added for short mules.

Section 2.—Twist, reeled yarn, doubling, or pin cop weft counts spun upon mules of 1¼ inch or over, gauge will be discounted for size of mule up to 806 spindles.

Section 3.—All counts below 34's reeled yarn to be paid the same price per 1,000 hanks; but in ascertaining the price per 100 lb. hank by the actual count (even) spun.

CLAUSE III.—WEFT STANDARD.

Section 1.—The standard price for weft is 19·23d. per 1,000 hanks of 50's count, with 22·5 revolutions of the spindles per inch of yarn, on mules of 420 spindles each. A ½ per cent. is deducted

* Mr. Hill for the employers, Messrs. Edge for the card-room workers, Messrs. Wood & Bullough for the operative spinners, have for many years efficiently applied these lists in their secretarial functions.

for every additional 12 spindles beyond 420 up to and including 900 spindles, when the gauge of the spindles is $1\frac{1}{8}$ inch or below. Where, however, the number of spindles do not exceed 804, an extra 5 per cent. is allowed, and has been added for short mules.

Section 2.—Mules of $1\frac{1}{8}$ inch gauge of spindles and below to be considered *weft* mules; twist, reeled yarn, doubling, or pin cop weft counts spun on *weft* mules shall be discounted for length of mule up to 900 spindles each mule.

Section 3.—All counts below 36's weft to be paid the same price per 1,000 hanks; but in calculating the price per 100 lb. hank by the actual count (even) spun.

The foregoing standard prices per 1,000 hanks contained in Clauses I., II., and III., include 3 per cent. as agreed upon between the Federation of Master Cotton Spinners' and Amalgamation of Operative Cotton Spinners' Associations, dated 11th March, 1918, which is to be recognised as payment for all time necessary to be stopped for the ordinary weekly cleaning of the mules, and $\frac{1}{2}$ per cent. agreed upon between the Bolton Master Cotton Spinners' and Bolton and District Operatives Cotton Spinners' Associations, as payment for time lost during the periodical cleaning, i.e. cleaning through, cleaning inside carriages, and varnishing rollers, etc. Provided always that present systems of cleaning through in the mills under the jurisdiction of the two Associations shall be maintained without any further payment, and that the employer, at his own discretion, has the right to have the mules cleaned through four times per annum.

Clause IV.—Coarse Counts.

Section 1.—5 per cent. to be added upon all sizes of mules when spinning 40's twist, reeled yarn, doubling, or pin cop weft, or any count below.

Creelers on Coarse Counts.

Section 2.—When spinning 30's counts or below the spinner to engage, and the firm pay an extra full time creeler, unless spinning so slow as not to require one, or spinning from a single roving, or as may be otherwise arranged between the secretaries of the two Associations. In case a few sets only are required the spinner shall be paid an extra allowance at the rate of 5s. 3d. per week in lieu thereof if he cleans the bobbins, and at the rate of 3s. 6d. per week where the bobbins are removed uncleaned.

Clause V.—Hard or Soft Spun Yarns.

Section 1.—When spinning any twist count with more than the standard turns per inch, a new price shall be calculated by multiplying the current price per 100 lb. of such count by the square

root of the count for which the turns per inch actually being put in are the standard, and dividing the quotient by the square root of the counts set to spin.

Section 2.—When spinning soft weft yarns with more than two-and-a-half turns per inch *less* than is allowed by the standard, the price per 100 lb. shall be reduced by one-fifth the proportionate difference between the price per 100 lb. for each turn per inch beyond, and reckoning from the two-and-a-half turns per inch referred to.

N.B.—In spinning soft weft or hosiery yarns, to which this section may not always apply, the price for spinning such yarns shall be subject to arrangements in accordance with Clause XIX.

Clause VI.—Standard Speed.

Section 1.—The standard speed shall be taken in each mill, as the speed usually run at such mill. In case of alteration to a speed below such standard, the price per 100 lb. to be increased equal to two-thirds of the proportionate difference in reduction in size of the rim.

Section 2.—Five per cent. extra to be allowed when spinning with single and double speeds.

Clause VII.—Prices to be Paid Extra when Tubing.

Tubing per Set, Large Cops.

Spindles in Each Mule. Section 1.

	30's and under.	32's to 60's.	62's to 80's	82's to 100's.	102's to 120's.	122's to 140's.	142's to 160's.
	d.	d.	d.	d.	s. d.	s. d.	s. d.
600 and under	3	4	4½	5	0 5½	0 6	0 6½
602 to 648 .	3	4	4½	5	0 5½	0 6	0 6½
650 ,, 698 .	3½	4½	5	5½	0 6	0 6½	0 7
700 ,, 748 .	4	5	5½	6	0 6½	0 7	0 7½
750 ,, 798 .	4½	5½	6	6½	0 7	0 7½	0 8
800 ,, 848 .	5	6	6½	7	0 7½	0 8	0 8½
850 ,, 898 .	5½	6½	7	7½	0 8	0 8½	0 9
900 ,, 948 .	6	7	7½	8	0 8½	0 9	0 9½
950 ,, 998 .	6½	7½	8	8½	0 9	0 9½	0 10
1,000 ,, 1,048 .	7	8	8½	9	0 9½	0 10	0 10½
1,050 ,, 1,098 .	7½	8½	9	9½	0 10	0 10½	0 11
1,100 ,, 1,148 .	8	9	9½	10	0 10½	0 11	0 11½
1,150 ,, 1,198 .	8½	9½	10	10½	0 11	0 11½	1 0
1,200 ,, 1,248 .	9	10	10½	11	0 11½	1 0	1 0½
1,250 ,, 1,298 .	9½	10½	11	11½	1 0	1 0½	1 1

½d. per set to be added for every 20 hanks finer above 160's count.
Mules of 1,300 spindles each to be paid proportionate advance.

Tubing per Set, Pin Cops.

Section 2.—The price per set for tubing pin cops shall be equivalent to $\frac{1}{8}$ of a penny per lb. weight of such set, when spinning 60's to 100's count; with a penny per set added, for every 10 hanks, or fractional part of 10 hanks finer than 100's count; and a reduction of a $\frac{1}{2}$d. per set, for every 10 hanks or fractional part of 10 hanks coarser than 60's count down to 20's count.

Section 3.—Cops spun full length of spindles on mules of $1\frac{1}{4}$ inch gauge and over, to be paid for tubing in accordance with scale for large cops. When spinning full length cops on mules of $1\frac{1}{8}$ inch gauge of spindles or below, the price per set shall be the mean between the price per set allowed for large, and the price per set allowed for pin cops, same length of mule.

Section 4.—Full length tubes, large cops, to be paid double the rates given by Section 1. Full length tubes, pin cops, on 42's count or above, to be paid double the rates shown in Section 2; 40's count and below to be paid $\frac{1}{8}$ of a penny per lb. weight of the set.

Section 5.—Tubes put on with the apparatus to be paid two-thirds the above rates per set when spinning 100's counts or over, and three-fifths the rate per set when spinning 98's count or under.

Section 6.—All tubes, whether part or full length, to be weighed in as yarn, providing the weight of such tubes does not exceed 12 ounces per 1,000. Any excess beyond this weight to be deducted.

28*th January*, 1920.

Note.—When spinning exceptionally small pin cop on ordinary short tubes, the prices for tubing shall be calculated on the following minimum weights per set for the different lengths of mules, viz.:—

950 to 1,048	spindles,	40	lb.	weight	of set,	5d.	per set.
1,050 „ 1,148	„	44	„	„		5½d.	„
1,150 „ 1,248	„	48	„	„		6d.	„
1,250 „ 1,348	„	52	„	„		6½d.	„
1,350 „ 1,448	„	56	„	„		7d.	„

The foregoing prices do not apply to through tubes.

Cleaning and Oiling Time.

In accordance with the Agreement entered into between the Master and Operative Cotton Spinners' Associations, in the year 1893, and amended by the "Cleaning Time Agreement," entered into between the Federation of Master Cotton Spinners' and the Amalgamation of Operative Cotton Spinners' Associations dated 11th March, 1918, the time to be allowed for cleaning machinery in the spinning rooms is as follows:—

				Hours per week.
On mules of	950	spindles and under, with two piecers	. .	$1\frac{3}{4}$
,,	952	,, to 1,070 spindles ,,	. .	2
,,	1,072	,, or over, with ,,	. .	$2\frac{1}{2}$
,,	1,072	,, with three piecers	. .	2

The above allowances include the half-hour from 11·30 to 12 a.m. on Saturdays.

The cleaning thus provided for is the ordinary cleaning only. "Cleaning through," "cleaning inside carriage," and "varnishing rollers," being extra cleaning is to have such extra time allowed in addition to the above scale, as is found to be necessary, such extra allowance to be arranged between the men and their employer at each mill.

It is agreed that all portions of headstocks and gearing that cannot be oiled safely with the "straps" running, will be oiled by the operative spinner before the engine starts in the morning and during meal hours.

It is further agreed that where a mule is broken down on the day on which the usual weekly cleaning is performed, the spinner shall, if so required, proceed to do the cleaning during such breakdown, but the time occupied by such cleaning shall be deducted from any claim he may have for compensation under Clause XI. of the standard list of prices.

Note.—On mules driven direct from the line shaft the back of the headstock must not be cleaned whilst the strap is in motion.

N.B.—The full published lists are very comprehensive and contain many worked-out tables, but only the fundamental clauses are here reproduced.

Bolton Spinners' Indicator List.

In addition to the well-known Bolton Weight List, there are in the Bolton province many different lists of payment by indicator. This is the result of individual firms having agreed with their spinners, upon a system of payment by indicator. This brings before our notice the two different methods of payment by indicator adopted in the largest cotton spinning districts, Bolton and Oldham. When indicators are used in Bolton the payment is at the rate of so much per 100 draws, this system being also often used in Continental and Indian spinning mills. In Oldham district, however, the indicators record the number of hanks, and a rate of payment is calculated at so much per 1,000 hanks.

The following may be taken as a typical example of the method of payment by indicator adopted in Bolton.

Clause 1 *of the Agreement.*—Gross minimum wage to be £3 7s. (pre-war).

Mules of 1,016 spindles each 3d. per set to be added for doffing.

Clause 2.—With 1s. to be added in each case for pin cops, 5 per cent. to be added to the gross wages earned (exclusive of tubes) when spinning 30's to 20's counts, and 7½ per cent. added when spinning 18's counts and under. In both cases irrespective of the extra creeler, if such has to be provided as per clause, by section 2 of the standard weight list.

Clause 3.—A factory week to be equal to 55½ hours, less 1¾ hours for cleaning, and 1 hour 20 minutes for breakages, leaving a net week of 52 hours 25 minutes = 188,700 seconds.

Clause 4.—Present speeds of the mules are and shall be taken as the standard speeds. If these are increased a higher basis and consequently fresh calculation of prices shall be made and agreed upon between the two Associations.

Clause 5.—Refers to tubing, stripping creels, and other conditions, which must be paid for in accordance with the weight list. Apparently when price standards are being fixed by the weight list the spinners like a low standard speed establishing. With indicators they like a high standard.

Clause 6.—All timings to be taken in the middle of the cop and to be an average of all the mules working under same conditions. When spinning a fraction beyond ¼ second the spinner to be paid for the next ¼ second slower or higher. This basis is subject to revision in the event of the present machinery being replaced.

A gross wage of £3 7s. has been agreed upon and the net working time per week shall be 188,700 seconds. From these figures, together with the seconds occupied in spinning one draw, we are able to calculate the base price per 100 draws which must be paid. We will assume that the average timings of all the mules working under the same conditions, has come out at 22 seconds per draw, 6 of these seconds being occupied by backing off, and running in, leaving 16 seconds actual spinning time.

$$\frac{188700}{22} = 8{,}577 \times 2 = 17{,}154$$

Seconds per draw. Draws. Mules. Draws per week.

£3 7s. = 804d., and if the price is 804d. for 17,154 draws, what will it be per 100 draws:

$$\frac{804\text{d.} \times 100}{17154} = 4{\cdot}6869\text{d. per 100 draws.}$$

Suppose we have taken 89 twist wheel as a basis, this wheel being in actual use at the time, we are enabled to form a scale of

payment per tooth of twist wheel for a range of wheels. For our example we will compile a scale of prices for a range of wheels from 69 to 109.

Base		Revs. of rim per draw.
89 twist wheel, assuming twice round	= 89 × 2 =	178
69 „ „ „	= 69 × 2 =	318
109 „ „ „	= 109 × 2 =	218

Take the 69 first :

$$\frac{16 \text{ secs. spinning time} \times 138 \text{ revs. of rim}}{178 \text{ revs. of rim}}$$

= 12·4 secs. + 6 secs. for backing off and running in
= 18·4 secs. for complete draw with 69 twist wheel.

$$\frac{188700 \text{ secs.}}{18{\cdot}4 \text{ secs.}} = 10{,}255 \text{ draws} \times 2 = 20{,}510 \text{ draws per week 2 mules.}$$

If the price is £3 7s. or 804d. for 20,510 draws, what will it be per 100 draws?

$$\frac{804\text{d.} \times 100}{20510} = 3{\cdot}9200\text{d. per 100 draws with 69 twist wheel.}$$

89 base wheel = 178 revs. of rim and base price 4·6869d.
69 wheel = 138 „ „ and price 3·9200d.
40 revs. difference ·7669d. difference

$$\frac{{\cdot}7669}{40} = {\cdot}0191\text{d. per rev. of rim}$$

and ·0191 × 2 = ·0382d. per tooth of twist wheel.

We will proceed on same lines for the 109 twist wheel.

$$\frac{16 \text{ secs. spinning time} \times 218}{178} = 19{\cdot}6 \text{ secs.} + 6 \text{ secs.}$$

= 25·6 secs. per draw.

$$\frac{188700 \text{ secs.}}{25{\cdot}6} = 7{,}371 \text{ draws} \times 2 = 14{,}742 \text{ draws per week.}$$

$$\frac{804\text{d.} \times 100}{14742} = 5{\cdot}4538\text{d. per 100 draws with 109 T.W.}$$

218 revs. of rim with 109 T.W. and price 5·4538d.
178 „ „ 89 „ and base price 4·6869d.
40 rev. difference ·7669d. difference.

$$\frac{{\cdot}7669}{40} = {\cdot}01917 \text{ per rev. of rim}$$

·0191 × 2 = ·0382d. per tooth of twist wheel.

We are now able to compile a table of prices for every tooth of twist wheel from 69 to 109 inclusive. By starting at our base wheel, 89 and the base price of 4·6869d. and working downwards to 69 T.W. and upwards from 89 to 109 and deducting ·0382d. or adding the same amount as the case may be we get a scale per tooth as follows :—

d.	d.	d
69 = 3·9229	83 = 4·4577	97 = 4·9925
70 = 3·9611	84 = 4·4959	98 = 5·0304
71 = 3·9993	85 = 4·5941	99 = 5·0681
72 = 4·0375	86 = 4·5723	100 = 5·1063
73 = 4·0757	87 = 4·6105	101 = 51445
74 = 4·1139	88 = 4·6487	102 = 5·1827
75 = 4·1521	89 = 4·6869	103 = 5·2209
76 = 4·1903	90 = 4·7251	104 = 5·2591
77 = 4·2285	91 = 4·7633	105 = 5·2973
78 = 4·2677	92 = 4·8015	106 = 5·3355
79 = 4·3049	93 = 4·8397	107 = 5·3737
80 = 4·3431	94 = 4·8779	108 = 5·4119
81 = 4·3813	95 = 4·9161	109 = 5·4501
82 = 4·4195	96 = 4·9543	

In order to prove that the scale is correct we should be able to take any twist wheel and its corresponding price and work back to the gross minimum wage agreed upon, which in every case should give 804d. = £3 7s. As an example we will take the 69 wheel and its price 3·9229d.

$$\frac{16 \text{ secs.} \times 138}{178} = 12{\cdot}4 + 6 \text{ secs.} = 18{\cdot}4 \text{ secs.}$$

$$\frac{188{\cdot}700 \times 2}{18{\cdot}4} = 20{,}510 \text{ draws.}$$

If the price per 100 draws with a 69 wheel is 3·9229d. what will it be for 20,510 draws ?

$$\frac{3{\cdot}9229 \times 20510}{100} = 804\text{d.} = £3\ 7\text{s.}$$

The foregoing example has been worked from the simplest form of twist motion, namely, a single worm on rim shaft driving the twist wheel. If we were calculating on another form of twist motion, say Threlfall's, we should require to find revolutions of rims as follows. Assume single worm on rim shaft, worm wheel of 55 teeth, twist wheel 48, large part of twist carrier 60, small part of twist carrier 30, and driven wheel on twist shaft 98.

$$\frac{55 \times 60 \times 98}{1 \times 30} = \frac{10780 \text{ twist constant}}{48 \text{ twist wheel.}} = 224 \text{ revs. of rim.}$$

Having found revolutions of rim per stretch we should proceed as before with our calculation of price per revolution of rim shaft. In this case, however, we should find that as our twist wheels increase in size, the price per 100 draws decreases, because the twist wheel is a driver and not a driven wheel as in previous example. On mules that have no twisting motion and back off as soon as they reach the head, the speed wheel is taken as the basis.

Mule Hank Indicators, Oldham.

It is a condition of the Oldham Spinners' Price List that payment shall be by indicators which register the number of hanks spun, and these indicators to be so constructed as to allow $2\frac{1}{2}$ per cent. for breakage. It is within the author's personal experience that indicator payment in Oldham has been almost universally adopted since before 1890. The indicators are fixed to the back shaft of the mule and by a system of worm and wheel gearing, the indicator finger, which is connected to the last wheel, on the completion of one full revolution of this wheel, registers 20,000 hanks. Some indicators are made to register once in three draws and others twice in three draws. There are usually three wheels in the mechanism, and these will be found to vary in size in order to compensate for the varying lengths of stretch and numbers of spindles found on different mules. The teeth of the three wheels multiplied together, along with the number 3 or $\frac{3}{2}$ according to how the indicators register, will give the number of draws that have been run, and the draws multiplied by the number of spindles in the mule and by the length of stretch (including roller motion) will give the number of inches. Divide these by 36×840 and the result will be the number of hanks spun while 20,000 hanks are registered. The answer should be approximately 20,000 plus $2\frac{1}{2}$ per cent. for breakage.

As an example we will assume that an indicator registers twice in three draws, contains wheels with 7, 19, and 36 teeth, 64 inch stretch, 1,350 spindles :

$$\frac{3 \times 7 \times 19 \times 36 \times 64 \times 1350}{2 \times 36 \times 840} = 20{,}520 \text{ hanks.}$$

From the foregoing find what wheel would be required to give the $2\frac{1}{2}$ per cent. breakage :

$$\frac{2 \times 36 \times 840 \times 20520}{3 \times 7 \times 19 \times 1350 \times 64} = 36 \text{ wheel required.}$$

Find number of spindles in the mule :

$$\frac{2 \times 36 \times 840 \times 20520}{3 \times 7 \times 19 \times 36 \times 64} = 1{,}350 \text{ spindles.}$$

Find length of stretch :

$$\frac{2 \times 36 \times 840 \times 20520}{3 \times 7 \times 19 \times 36 \times 1350} = 64 \text{ stretch.}$$

The exact amount given by the $2\frac{1}{2}$ per cent. for breakage would be

$$\frac{20000 \times 100}{97{\cdot}5} = 20{,}512 \text{ against } 20{,}520.$$

The discrepancy is so small, however, that the indicators would be considered correct as it would probably be found impossible to arrange the combination of wheels to yield the exact number of hanks with the number of spindles and length of stretch as stated. The finest alteration of wheels we could get in this case would be to change the 36 inch wheel 1 tooth to 35 or 37. In the former case the result would be 19,950 hanks and with the latter change 21,090 hanks.

As previously stated the hanks indicator is the one that is adopted in conjunction with the Oldham list of wages. In perusing this list the first thing to notice is the fact that no prices per 100 lb. or per 1,000 hanks are given at all. A table is compiled giving the total earnings that should be obtained from any size of mule commencing at 36 dozen and going up to 116 dozen. The table tells us that a spinner's total earnings for 36 dozen spindles should be £1 17s., and as the number of spindles increases, the total earnings increase also, until by the time 116 dozen is reached the total earnings are £3 15s. 4d. on the pre-war basis.

Oldham Spinners' Price List.

In cases where spinning mules are running quicker than 3 draws in 44 seconds, with 63 inch draw, for any counts of yarn (twist or weft) one-half the advantage of the difference arising from quicker speeds, shall be added to total earnings as in following list :—

Dozen.	Amount to be added for each second quicker than 3 in 50. d.	Dozen.	d.	Dozen.	d.
36	$4\frac{1}{4}$	64	$6\frac{1}{4}$	92	$7\frac{1}{2}$
40	$4\frac{1}{2}$	68	$6\frac{1}{2}$	96	$7\frac{3}{4}$
44	$4\frac{3}{4}$	72	$6\frac{3}{4}$	100	$8\frac{1}{4}$
48	5	76	7	104	$8\frac{3}{4}$
52	$5\frac{1}{4}$	80	$7\frac{1}{4}$	108	$8\frac{3}{4}$
56	$5\frac{1}{2}$	84	$7\frac{1}{4}$	112	9
60	6	88	$7\frac{1}{2}$	116	9

For mules running quicker than 3 draws in 50 seconds, with 63 inch draw, but not running quicker than 3 draws in 44 seconds, the quick speed allowance shall be one-twelfth of the seconds quicker than 3 draws in 50 seconds at the above rates per second. Other lengths of draws in proportion.

Clause No. 1.—The mode of calculating length of yarn spun by spinning mules to be as follows :—

From 56½ hours shall be deducted : For the Oldham type of mule an allowance of 2¾ hours, and for the Bolton type mule an allowance of 3½ hours for single thread and all fluker shaft mules, and 3¼ hours for two thread of 1¼ inch gauge and under for accidental stoppages and for cleaning each week. Three-quarters of an hour in each case being the allowance for accidental stoppages referred to.

It is further agreed that the cleaning time allowed and paid for, does not include time for varnishing rollers.

(2) An allowance for doffing time as follows :—

For each pair of mules of 60 dozen spindles and under, 5 minutes.

For each pair of mules over 60 dozen spindles and less than 90 dozen, 6 minutes.

For each pair of mules of 90 dozen spindles and upwards, 7 minutes. Number of doffings reckoned off one mule only.

(3) An allowance of 2½ per cent. for breakage.

Clause No. 2.—Mule indicators to be so constructed as to allow 2½ per cent. for breakage.

We can now take an example of how the price per 1,000 hanks is obtained.

A pair of mules are spinning 32's twist, 960 spindles, 64 inch draw, 18 inch rim, 53 back change wheel, and doffing 8 times each mule per week, with a speed of 3 draws in 41 seconds. Oldham type of mule.

56½ hours less 2¾ hours on this type of mule for cleaning and accidental stoppages.

56½ hours	
2¾	
53¾ =	53 hours, 45 minutes
	60
	3,225 minutes
less	48 minutes for 8 doffings at 6 minutes each
	3,177
less	79 minutes for 2½ per cent. breakage
	3,098
	60
	185,880 seconds.

$$\frac{185880 \times 960 \times 64 \times 3 \times 2}{36 \times 840 \times 41} = 55{,}267 \text{ hanks.}$$

The list tells us that for 960 or 80 dozen spindles, the gross earnings are fixed at £2 19s. 10d., but this wage is for mules running 3 draws in 50 seconds, ours are running 3 draws in 41 seconds.

Old Quick Speed Clause.

If the standard timing is 3 in 50 for 63 inches, what will it be for 64 inches 3 in 41? $= \frac{41 \times 63}{64} = 40{\cdot}36$ seconds for 3 draws. The allowance we should have for quick speed is therefore $50 - 40{\cdot}36 = 9{\cdot}64$ seconds at $7\frac{1}{4}$d. per second, according to list. $7\frac{1}{4}$d. $\times$ 9·64 = 69·89d., say 70d. = 5s. 10d.

£2	19	10
0	5	10
£3	5	8 gross wage

$$= \frac{788\text{d.} \times 1000 \text{ hanks}}{55267 \text{ hanks}} = 14{\cdot}25\text{d. per 1,000 hanks.}$$

This is the standard price at which the minder's wage would be reckoned until the speed of the mules was altered.

Quick Speed Clause.

By an agreement dated 5th December, 1907, the following clause came in operation on 1st January, 1908:—

That the quick speed clause of the Oldham list be modified so that the mules running slower than 3 draws in 44 seconds for a 63 inch stretch have added to their gross earnings payment for one-twelfth of the number of seconds they run quicker than 3 draws in 120 seconds for a 63 inch stretch, at the rate per second provided for in the quick speed clause. Those mules now running quicker than 3 draws in 44 seconds for a 63 inch stretch to continue to receive what the present clause gives them.

The foregoing example does not require modification of quick speed rates because the mules are running quicker than 3 draws in 44 seconds. We will assume, however, that the speed was 3 draws in 46 seconds with a 63 inch stretch, there would then be $50 - 46 = 4$ seconds already paid for under the old clause. Whatever the spinner receives under the old clause must be deducted from what the new clause gives. New clause gives $120 - 46 = 74$ seconds at the rate of $\frac{1}{12}$. Therefore, $\frac{74}{12} = 6\frac{1}{6}$ seconds, $6\frac{1}{6} - 4$ seconds under

old clause = $2\frac{1}{6}$ seconds difference to be paid for at $7\frac{1}{4}$d. per second = $7\frac{1}{4}$d. × $2\frac{1}{6}$ = 15·66d.

The above method only applies where the speed of mules is between the old and new standards = 3 in 50 and 3 in 44.

If the mules had been running at a slower rate than 3 in 50 with 63 inch stretch, say for example 3 in 54, 120 – 54 = 66 seconds at the rate of $\frac{1}{12}$ would be the amount to be paid for $\frac{66}{12}$ = $5\frac{1}{2}$ seconds at $7\frac{1}{4}$d. per second for 80 dozen spindles.

Payment for Roller Motions.

Where roller motions are employed, the minder is to be paid for yarn produced by the same, whether the mules run quicker or slower than 3 draws in 50 seconds, according to the scale in list at so much per second. Thus: given a pair of mules 64 inch stretch, allowing 4 inches roller motion, and running 3 draws in 55 seconds, add the roller motion to nominal stretch, making in this case 68 inches. Then if 68 inches gives 3 in 55 seconds, 64 inches gives 3 in 52 seconds (nearly). Deduct one from the other and allow the proper amount for the 3 seconds as per scale.

Definition of Types of Mule. Bolton and Oldham.

A Bolton type of mule is a mule with rollers having one end to a boss and/or fitted with fluker shafts. Also mules with two threads to a boss of $1\frac{1}{4}$ inch gauge or finer.

An Oldham type of mule is a mule with rollers fitted with underclearers (crows) having three or four ends to a boss, and mules of two ends to a boss of wider gauge than $1\frac{1}{4}$ inches.

Spinners' Prices and Method of adding Percentages.

It was agreed between the two Associations at a meeting held on the 16th May, 1918, that all existing scales per tooth of wheel and per inch of rim should be subject to the same advances or reductions as the base price, and that all existing scales of wheels not exceeding $\frac{1}{16}$d. per tooth for quick speeds and $\frac{1}{8}$d. per tooth for slow speeds shall be deemed to be standard.

Summary of Cardroom List. Bolton and District.

STRIPPERS AND GRINDERS.

Standard rate of wages and conditions of work agreed upon between the Bolton Master Cotton Spinners' Association and the Cardroom Workers' Association for 20 cards per man.

Basis wages, 27s. 3d. per week of 48 hours.

Work to be Performed.

Strip cylinders twice per day.

Strip doffers twice per day.

Strip cylinders and doffers once on Saturdays.

Grind through all cards, including flats, once per week.

Brush undercasings when grinding and brush out cards weekly when grinding is not required.

Oil all cards throughout once per week, quick moving parts as required.

Attend to all straps and bands on cards.

One frame per week to be scoured by each two men.

Brush shafting, beams and pulleys in card and frame rooms once per week.

Clam shafting twice per annum.

Clean coilers, feed rollers and feed roller wheels twice per annum.

Clean and re-fill fire buckets once per week.

Assist at re-clothing cards.

Assist in lifting out and putting in calendar rollers in blowing room.

1s. 3d. extra for each card over 20 cards per man.

2s. 6d. per man extra for each round of stripping, cylinder or doffer, in excess of the number provided for in this schedule.

Where frames are situated outside the cardroom such places to be considered as part of the cardroom.

Where the number of cards or the work required is less than the standard provided for in this schedule, additional duties in lieu thereof shall be subject to mutual arrangement between the two secretaries, and in the event of their failing to agree, the matter shall be referred to the committees of the two Associations.

The age of promotion to grinding shall be 19 years, and no person shall be eligible for the position unless and until he has been employed in the card or blowing room for a period of two years, twelve months of which must be spent consecutively in the occupation of a card tenter, or lap carrier, where male card tenters are not employed.

Card Tenters.

Card tenters to be paid at the rate of 10·38d. per card with a production of 400 lb. per card per week, an addition of ·43d. per card to be made for each 50 lb. over 400 lb., and a deduction of ·43d. per card for each 50 lb. below 400 lb.

The production of the cards shall be calculated from the hanks registered on the slubbing frames in all cases, provided that on each combed preparation 15 per cent. shall be added to compensate for waste.

In arriving at the weight per card no alteration in price shall be made unless and until the difference exceeds half the difference between one scale and the other.

Drawing Frames.

The standard price for drawing frames to be at the rate of 10·38d. per delivery for 18 to 21 deliveries.

An addition of 6·92d. per delivery to be made for each delivery from 22 to 24 deliveries inclusive; 5·19d. per delivery for each delivery from 25 to 27 deliveries inclusive, and 3·46d. per delivery from 28 deliveries and over.

A reduction of 5·19d. per delivery to be made for each delivery below 18.

It will be remembered that exact wages paid and most detailed conditions are always subject to adjustment by mutual agreement and usually differ more or less from the standard list either up or down.

Heilmann Combers.

The standard price for combers to be as follows :—

Heilmann Combers.

7½ inches lap and under, 36 laps = 13s. 7d. per week; to rise and fall 3·6d. per lap.

8½ inches lap, 36 laps = 14s. 3d. per week; to rise and fall 3·46d. per lap.

10½ inches lap and over, 36 laps = 15s. 2d. per week; to rise and fall 3·46d. per lap.

Nasmith Combers.

10½ inches lap and over basis = 6·27d. per lap. 30 laps = 15s. 8d. per week; to rise and fall 5·19d. per lap.

Drawing comber fly to be subject to Clause I. of the supplementary clauses.

Ribbon and Sliver Lap Machines.

The standard for lap machines to be as follows :—

	Per week.
3 machines 10½ inches lap and over	13s. 5d.
2 machines 10½ inches lap and over, and 2 combers	13s. 5d.
2 machines 10½ inches lap and over, and 1 head of drawing	13s. 5d.
2 machines 10½ inches lap and over	12s. 6d.
3 machines 8½ inches lap and under	12s. 6d.
2 machines 8½ inches lap and under, and 2 combers	12s. 6d.
2 machines 8½ inches lap and under, and 1 head of drawing	12s. 6d.
2 machines 8½ inches lap and under	11s. 8d.

The standard wages for these machines are for the production of a lap of $10\frac{1}{2}$ inches in $4\frac{1}{4}$ minutes; where, however, the speed is quicker than $4\frac{1}{4}$ minutes the tenters shall not be employed on more than two machines.

NOTE.—It must be remembered that published standard list prices constitute the basis upon which actual wages rise or fall and not themselves the actual wages paid at any given time. In 1920, 100d. standard list, became 315d. actual at its highest. By August, 1922, the rates had been very materially lowered again.

SLUBBING FRAMES.

(Worked Singly.)

The standard to be at the rate of 16s. for 90 spindles, rising and falling 10·38d. for 10 spindles at the rate of 1·73d. for each 2 spindles up to 8, and 3·46d. 8 to 10 spindles.

A reduction of 5 per cent. to be allowed when the speed of spindle does not exceed 400 revolutions per minute.

No. of Spindles in each Frame.	Wages of Tenter.	No. of Spindles in each Frame.	Wages of Tenter.
	s. d.		s. d.
60	13 5	86	15 7
62	13 7	88	15 9
64	13 8	90	16 0
66	13 10	92	16 2
68	14 0	94	16 3
70	14 3	96	16 5
72	14 5	98	16 7
74	14 7	100	16 10
76	14 8	102	17 0
78	14 10	104	17 2
80	15 2	106	17 4
82	15 3	108	17 5
84	15 5	110	17 9

SLUBBING FRAMES.

(Worked in Pairs.)

The standard to be at the rate of 17s. 4d. for a pair of frames having 70 spindles each, rising and falling 8·65d. for each 10 spindles at the rate of 1·73d. for each 2 spindles.

A reduction of 5 per cent. to be allowed when the speed of spindle does not exceed 400 revolutions per minute.

With assistance of back tenter to two frames at 7s. 4d. rising and falling 5·19d. for each 10 spindles.

Intermediate Frames.

The standard price to be at the rate of 17s. 9d. per week per pair of frames of 130 spindles each, rising and falling 8·65d. for each 10 spindles.

A reduction of 5 per cent. to be allowed when the speed of spindle does not exceed 550 revolutions per minute.

With assistance of back tenter as follows :—

Frames having 130 spindles and below, 1 back tenter to 4 frames.
„ „ 131 to 160 spindles, 1 „ „ 3 „
„ „ 161 spindles and over, 1 „ „ 2 „

Each back tenter to be paid at the rate of 8s. 8d. per week.

No. of Spindles in each Frame.	Wages of Tenter.	No. of Spindles in each Frame.	Wages of Tenter.	No. of Spindles in each Frame.	Wages of Tenter.
	s. d.		s. d.		s. d.
90	14 10	118	16 10	146	18 10
92	15 0	120	17 0	148	19 0
94	15 1	122	17 2	150	19 2
96	15 3	124	17 3	152	19 4
98	15 5	126	17 5	154	19 5
100	15 7	128	17 7	156	19 7
102	15 8	130	17 9	158	19 9
104	15 10	132	17 10	160	19 11
106	16 0	134	18 0	162	20 0
108	16 2	136	18 2	164	20 2
110	16 3	138	18 3	166	20 4
112	16 5	140	18 5	168	20 5
114	16 7	142	18 7	170	20 7
116	16 8	144	18 9		

Single Intermediates.

Where firms desire to have intermediate tenters attending to one frame only, and the number exceeds the proportion of joiner tenters allowed, the standard for attending a single frame to start at 12s. 8d. for 90 spindles and increase by 1d. or 2d. per 2 spindles until it reaches 16s. 9d. for 170 spindles. The list schedules the *exact* price for each size of frame.

Jack Frames.

The standard price for Jack frames to be at the rate of 18s. 4d. per pair of frames having 200 spindles each frame, rising and falling 8·65d. for each 10 spindles, a reduction of 5 per cent. to be allowed when the speed of spindle does not exceed 1,000 revolutions per minute.

With assistance of back tenter as follows :—

1 to 4 frames on 8 hank roving and below.
1 to 5 frames over 8 hank and not over 12 hank.
1 to 6 frames over 12 hank roving.

No. of Spindles in each Frame.	Wages.	No. of Spindles in each Frame.	Wages.	No. of Spindles in each Frame.	Wages.
	s. d.		s. d.		s. d.
150	14 8	182	17 0	214	19 4
152	14 10	184	17 2	216	19 5
154	15 0	186	17 4	218	19 7
156	15 2	188	17 5	220	19 9
158	15 3	190	17 7	222	19 11
160	15 5	192	17 9	224	20 0
162	15 7	194	17 10	226	20 2
164	15 9	196	18 0	228	20 4
166	15 10	198	18 2	230	20 6
168	16 0	200	18 4	232	20 7
170	16 2	202	18 5	234	20 9
172	16 3	204	18 7	236	20 11
174	16 5	206	18 9	238	21 0
176	16 7	208	18 10	240	21 2
178	16 9	210	19 0		
180	16 10	212	19 2		

Wages of Back Tenters.

	s.	d.		s.	d.
200 spindles and below	7	4	222 to 230 spindles and below	8	0
202 to 210 ,, ,,	7	7	232 to 240 ,, ,,	8	3
212 to 220 ,, ,,	7	9			

Roving Frames.

The standard number of spindles and basis wages shall be the mean between the Intermediate and Jack frames.

Basis or standard ranging from 18s. 1d. per week for a pair of frames each containing 166 spindles up to 20s. 6d. for each frame 200 spindles. When running one Slubber and one Intermediate, or Intermediate and Rover, or one Rover and one Jack together, the wages shall be the mean between the basis wages of pairs in each case.

Where a firm desire to have Jack frame tenters attending to one frame only, and the number exceeds the proportion of joiner tenters allowed, the wage for attending a single Jack frame to be in accordance with a printed scale, which starts at 11s. 6d. for a frame

of 150 spindles, reaches 14s. 5d. for 200 spindles, and goes up to 16s. 9d. for 240 spindles.

Jack frames are understood to be always those frames which supply the mules.

Supplementary Clauses.

There are various supplementary conditions, regarding cleaning and other features.

Wheel cleaning forms part of the ordinary duties of a frame tenter up to twice per annum when cleaned in sections of one or two boards per week. When frames are stopped and all this cleaning done at one time the standard payment becomes 1s. per frame.

When scouring frames, all time stopped in excess of 1½ hours to be paid for at the ordinary rate of wages.

Tenters employed on double geared frames to be paid 1s. per week for each extra gearing end.

Tenters on spindle frames called upon to break out to be paid 3d. per frame.

Tenters kept in mill waiting for back stuff, empty bobbins, or other material are entitled to inform the overlooker they are either leaving the mill, or shall be found other work and paid their ordinary rate of wages.

Two joiner tenters allowed in a mill of under 60,000 mule spindles, and four in a mill containing 60,000 to 100,000 mule spindles, six joiner tenters (two Intermediates and four Jacks) in a mill of over 100,000 spindles. Each ring spindle to be calculated as equal to 1½ mule spindles.

A back tenter to be the assistant of the frame tenter and not to do general work, clean bobbins from spinning rooms, or fetch bobbins from spinning room, except when frames are stopped; they must mop passage at frame ends or cardroom closets when required. When a back tenter is absent 90 per cent. of her wages to be divided between the persons doing her work.

Disputes may be first referred to the respective secretaries of employers and operatives, or still further to the joint committees.

Definitions and Explanations.

GRINDERS.

1. Brushing down means up to and including, shafting, beams, and pulleys over Jack frames.

2. Moving burnishing brush to count as equivalent to moving a grinding roller.

3. In scouring frames, eight deliveries of drawing to equal one spindle frame.

4. Attend to card straps means to piece, and also to clean and keep the driving surface in an efficient state.

5. Clean coilers means grinders to take to pieces, actual cleaning done by card tenters; under-carder to put together again.

6. When grinding through twice per week the schedule to be amended as follows:—

Strip cylinders once per day.
Strip doffers once per day.
All other duties as stated in the list.

In the event of stoppage of main engines or main driving power, cardroom workers shall remain in the mill one hour, and if kept longer shall be paid standard wages for *all* the time stopped.

The time a male card tenter may be off for illness shall not be taken as breaking his continuation of service for promotion to grinding.

In 1920 prices generally were about 215 per cent. above standard. Reductions near end of 1921 brought the price down considerably. Followed in April, 1922, by a master's first demand for 70 per cent. further and settled on the terms mainly of such reduction coming into force gradually.

Cop Packers.

By a Bolton agreement in December, 1920, the following local conditions were arranged.

It is hereby agreed that the prices and conditions of work for cop packers shall be as follows:—

STANDARD RATES.

Twist cops	2d. per 100 lb.
Bastard cops over $6\frac{1}{4}$ inches long . .	3d. „ „
„ „ $5\frac{1}{2}$ inches to $6\frac{1}{4}$ inches long	$3\frac{1}{2}$d. „ „
Pin cops over 5 inches long . . .	4d. „ „
„ $4\frac{1}{2}$ inches to 5 inches long .	$4\frac{1}{2}$d. „ „
„ below $4\frac{1}{2}$ inches long . .	$5\frac{1}{4}$d. „ „

When packing twist cops 100's counts and over, $\frac{1}{2}$d. per 100 lb. to be added to the foregoing price.

When packing pin cops 90's to 120's counts, $\frac{1}{2}$d. per 100 lb. to be added, and when packing counts (pin cop) over 120's a further increase of $\frac{1}{2}$d. per 100 lb. to be added to the above prices.

Pin cop below 4 inches long to be specially dealt with as occasion arises.

Measurement to be taken from point of cop to include $\frac{1}{8}$ inch of the tube at cop bottom.

At the date of above agreement the above prices were subject to 215 per cent. advance, but the per cent. advance later on became reduced as for other cotton operatives.

Universal List for Ring Spinning.

COUNTS—NORMAL TWIST. PRICES FOR 100 SPINDLES.

8's and 9's.	10's and 11's.	12's and 13's.	14's to 16's.	17's to 21's.	22's to 28's.	29's to 36's.	37's to 42's.	43's and upwards.
3s. 7d.	3s. 4d.	3s. 1d.	2s. 9½d.	2s. 7d.	2s. 5d.	2s. 4d.	2s. 3d.	2s. 2d.

COUNTS—EXTRA HARD TWIST. PRICES PER 100 SPINDLES.

8's.	10's.	12's to 14's.	16's to 18's.	20's to 24's.	26's to 28's.	29's and upwards.
3s. 1d.	2s. 9½d.	2s. 7d.	2s. 5d.	2s. 4d.	2s. 3d.	2s. 2d.

MINIMUM TURNS FOR EXTRA HARD TWIST.

Counts.	Turns per Inch.	Counts.	Turns per Inch.
8's	18·1	26's	32·633
10's	20·217	28's	33·862
12's	22·169	29's	34·470
14's	23·942	32's	36·204
16's	25·6	34's	37·318
18's	27·148	36's	38·4
20's	28·620	38's	39·449
22's	30·016	40's	40·473
24's	31·345	42's	41·472

Conditions.

1. Spinners shall not be called upon to assist in doffing or in gaiting up or laying on of empty bobbins, but must leave the ends up ready for doffers as far as practicable. After the ring frame has been doffed, the doffers or gaiters must gait all ends up, and leave the frame in spinning order, then the ring spinner takes charge of the frame.

2. Ring spinners to clean headstock and top part of frame down to and including the whole of the bolster rail and spindle sockets, and, except at week-ends, the poker rods. When changing travellers or breaking out, the datal ring spinner (not piecework spinner) to assist if the whole of her spindles are stopped.

3. The frame to be stopped when the headstock gearing is cleaned, and when the weights (running through the frame from one side to the other) which weigh the top front roller are required by the firm to be cleaned.

4. Poker rods at week-ends only and under the frame at all times to be cleaned by doffers and/or gaiters.

5. Rovings to be put on creels for ring spinners.

6. Counts to be taken as spun.

7. Extra hard twist to be paid for counts 50 per cent. finer than actual. Extra hard twist to be considered to be yarn with at least 60 per cent. more twist than normal, which is here taken to mean $\sqrt{\text{counts}} \times 4$. Special arrangements to be made for counts below 12's.

For weft on small pirns only, for the shuttle, 5 per cent. on above prices to be paid.

Double creels, when used, 1d. per 100 spindles extra.

In small mills—6,000 spindles for 36's, 4,000 for 18's to 36's, and 3,000 for under 18's, ring spinners may assist in doffing or gaiting.

The list is for a 48 hours week. To above notes it may be added that ring-jobbers, oilers and banders, ticketers, roving and ring bobbin carriers also have wage clauses.

Since the list was agreed upon prices have fallen considerably.

The information relating to wages given in this treatise, is designed chiefly to be educational and to give an idea of principles, methods and basis of wages payments. For up-to-date and very exact information reference must be made to Employers' or Operatives' Secretaries, who are invariably courteous, up-to-date, and exceedingly competent on these matters.

CHAPTER IX.

ABSTRACT OF FACTORY ACTS. FENCING.

Factory Acts.

The Factory Acts are very comprehensive, and include a good many points, of which a summary only is given below.

There must not be less than 250 cubic feet of space in any room for each employee therein.

Lime washing must be done at intervals not exceeding 14 months. Oil painting or varnishing every seven years, but washing of same in 14 months.

Fourteen months' intervals for examination of mill boilers and the inspection reports duly entered in proper register.

In factories erected since 1896, the carriages of self-acting mules must not be allowed to run out to within a distance of 18 inches from any fixed structure or part of machine and not to within 12 inches from any part of the headstock of another mule.

Young persons not more than 16 years of age must not be employed for more than 7 working days without a certificate of fitness from the certifying surgeon, unless the surgeon resides more than three miles from the factory, in which case the time must not exceed 13 days.

Any person under 14 years of age must not clean any machinery in motion.

A "child" (under 14) or a young person (under 18) or any woman may not clean any dangerous parts of machinery in motion.

Indicators must have marked on their cases the number of teeth in each wheel, and the diameter of the driving roller, except those for mules, which must have the number of teeth in each wheel, the number of spindles and the length of stretch.

A person commencing to occupy a workshop or factory is required to notify the inspector within one month.

Factory Acts must be posted up at the entrance of every factory and possibly also in other places.

The general register of the factory must show the following items:—

Children and young persons employed.
Limewashing dates.
Accidents of which notice is required to go to the Inspector.
Possibly other prescribed matters.

When artificial humidifying apparatus is used, the same should be reported to Inspectors, and in each room two sets of standardised wet and dry bulb thermometers must be provided, one set fixed in the centre, and the other at the side of the factory, plainly visible to the workers. It is deemed an offence to exceed prescribed limits of moisture.

Temperatures agreed upon as reasonable in 1912 were :—

	Max.	Min.
Cardrooms and ringrooms . . .	80°	60°
Mule rooms	95°	70°

Employers to provide thermometers in the spinning rooms.

Conference Fencing Laws.

I.—General Provisions (1912).

(*a*) On *new* machinery all projecting set-screws on continuously revolving parts shall either be countersunk or be otherwise efficiently protected ; where projecting set-screws are placed inside box pulleys they shall be deemed to be efficiently protected.

(*b*) On *new* card room machinery the following wheels shall be plated :—

(1) All driven pulleys.
(2) Pulleys on undershafts of draw-frames.

(*c*) Ladders, other than step-ladders, shall be fitted with hooks or other non-skid device—provided that in mule rooms or in rooms where persons work with bare feet, ladders shall not be fitted at the bottom with spikes.

(*d*) Heavy overhead main driving belts or ropes shall be guarded underneath in all cases where there is liability of persons having to pass under them.

Note.—This does not refer to the strap that drives the mules, nor to the rope-race in the engine-house (1912).

(*e*) It shall be obligatory on any woman or girl working about machinery to have her hair put up or otherwise confined in a net.

(*f*) All firms are to be urged to keep a supply of sterilised dressings, which shall be kept available for first aid for any operative who receives a cut or wound.

II.—Blowing-Room Machinery.

(*a*) Beater covers and the door immediately over the dirt grid shall be fitted with an automatic locking arrangement which renders it

impossible to open the covers while the beater is still running, or to restart the machinery until the doors have been closed.

(*b*) The nip between the cage wheels and calender wheels shall be efficiently protected on all machines. On new machines "spectacle" guards shall be provided, extending round the outer edge of both wheels.

(*c*) Fender guards should be provided for the fan side of scutchers, to guard the fan strap and slow motion strap. Provided that on existing machines where the slow motion pulley is driven directly by a strap from the overhead shaft, it shall be optional either to plate the wheel or to protect it by a fender guard. If the fan strap is on the opposite side to the slow motion strap, each strap shall be protected separately.

(*d*) Projecting ends of beater shafts shall be fitted with loose sleeves, or be otherwise protected.

III.—Carding Engines.

(*a*) All feed roller wheels, doffer and barrow wheels, side shaft wheels, calender wheels, and coiler wheels shall be efficiently fenced.

(*b*) All cylinder doors shall be fitted with an automatic locking motion which will prevent the door from being opened until the cylinder has ceased to revolve, and which shall render it impossible to re-start the machine until the door has again been closed.

(*c*) Licker-in covers shall be screwed down so that they cannot readily be lifted while the machine is in motion.

(*d*) In new machinery covers shall be extended as far as is reasonably practicable over the doffer.

(*e*) In new mills there shall be a space of at least 12 inches between the pulleys or the outermost parts between the cards, and at every third card a space of 24 inches.

IV.—Drawing Frames.

(*a*) The roller gearing shall be effectively covered, and on new frames the covers shall be automatically locked in such a way that they cannot be lifted while the machinery is in motion.

(It is understood that this rule shall not prohibit the overlooker from putting the lock temporarily out of action when changing the wheels, it being recognised that he must see them running in order to satisfy himself that they are properly set.)

(*b*) The pulley at the end of the frames shall be protected.

(*c*) The undershaft shall be covered.

V.—Speed Frames.

(*a*) Headstocks shall be fitted with metal plates to protect all jack-box wheels, and these on all new frames shall be fitted with

automatic locks which shall prevent the doors being opened while the machinery is in motion, and shall render it impossible to re-start the machine until the door has been closed.

(*b*) Draft change wheels, twist wheels and carrier wheels, bobbin driving wheels, and lifter wheels shall all be effectively protected.

(*c*) Bobbin skew gear wheels shall be covered over the top, and these covers shall be extended both in front and behind round the edge of the wheels, except in those cases where the spindles are not cleaned whilst the machinery is in motion.

(*d*) Spindle skew gear wheels shall be effectively covered. On new frames the covers shall be of metal (other than cast iron), and on old frames metal covers shall gradually be substituted for wooden ones as the necessity arises for their renewal.

(*e*) Lifter rack wheels shall be securely fenced, the guard to be such that it will effectively protect the nip both as the rail rises and as it falls.

(*f*) All new balance weights shall be cast with the eyelet forming part of the weights themselves.

VI.—Self-acting Mules.

(*a*) The guards for middle back shaft scrolls shall be fitted with flanges to protect the intake of the bands and the side of the scroll. The guards for middle draw band and carrier pulleys shall be either fixed to the bottom creel board, or be so fastened otherwise that they cannot readily be knocked aside. The side pieces of the guard shall be extended inwards far enough to completely guard the nip between the band and the scroll.

(*b*) On new machines the guards for faller stops shall consist of a cover over the stop. The combined guard and faller stop shall not be deemed to satisfy the requirements of this rule.

(*c*) On new machines the guards for end draw band pulleys shall be extended at least half an inch beyond the end of the pulley.

(*d*) Where persons have to stand on creels to attach driving belts (not counter-shaft belts), the two creels shall be joined together by timber to form a platform on which to stand, or some other equally safe method shall be adopted to the satisfaction of the Inspector.

(*e*) In new mills the space behind the mules shall not be less than 3 feet between the rovings.

(*f*) Metal fasteners shall not be used for overhead driving belts unless the belt itself be securely fenced—provided that this rule shall not apply to metal fasteners consisting of a continuous wire stitching held together by a peg other than a metal peg.

VII.—Ring and Throstle Frames.

(*a*) All cog wheels shall be securely fenced.

(*b*) The outer ends of the frames shall be filled in with metal plates.

(*c*) No banding of spindles shall be allowed while the frame is in motion where there is a double tin roller.

Cleaning Machinery.

Young persons shall not be allowed to clean the following parts of machinery while they are in motion :—

(*a*) *Blowing Room Machinery.*

No part which requires the removal of guards.

(*b*) *Carding Engines.*

(1) Sides and backs of cards, except with a handbrush.

(2) Doffer covers, comb-box, top of comb, and top of coiler, except with soft waste or strips.

(3) Other parts not to be cleaned at all while in motion.

(*c*) *Speed Frames.*

No part of machinery that it has been agreed requires guarding shall be cleaned whilst in motion, nor are the spindles between the bobbin and spindle skew gears to be cleaned whilst in motion, unless the guard for the bobbin skew is extended both in front and behind round the edge of the wheels.

(*d*) *Self-Acting Mules.*

(1) Back shaft scrolls, draw band, and carrier pulleys.

(2) Back carriage wheels and back of carriage.

(3) Quadrant pinions.

(4) Back of headstock, including rim pulley and taking-in scrolls.

(5) The whole of the front of the headstock.

It was further agreed that these restrictions should be deemed to apply only to persons under 18 years of age.

Self-Acting Mules.—Agreement 1913.

Fencing of Backshaft Scrolls, Carrier Pulleys and Draw Bands.

An efficient guard must comply with the following conditions :—

I.—General.

(*a*) Any movable parts of the guards must be provided with fastenings to prevent accidental removal or displacement through vibration.

(*b*) The edges of guards made of sheet metal must be wired or beaded (to prevent cuts or scratches).

(*c*) The guards must be securely fixed to the floor or to the machinery.

(*d*) The guards must be so constructed as be readily opened out or removed to allow the bands to be easily passed round the carrier pulleys and fitted to the scrolls.

(*e*) If the guards are made of sheet metal, the metal should be not less than 24 guage steel or 20 guage black iron.

Mill Hoists.

Many accidents have occurred owing to the use of mill hoists. Cotton spinning mills are very high—especially mule mills—and hoists have almost always been used to carry full bobbins from cardrooms to spinning rooms, and empty bobbins back. In former years the author used such hoists very frequently. Many patented devices have received more or less favour for preventing accidents through hoist doors being open when the lift or cage was not on same level.

Whatever the form of device now used it is supposed to fulfil the two essential conditions of : (*a*) May only be opened when the lift is in correct position for that floor. (*b*) Should have the ability to lock or snap itself fast on, or when the cage leaves that floor.

In some cases hinged doors are used which can only be unbolting, unlatching, or unlocking from the inside ; will automatically lock open when the lift is in position for that floor, but removal of the cage will automatically unlock from the open, and springs or weights will then close the door.

Electric lifts are now common in public buildings and sometimes in cotton mills. May be controlled by a switch or push button being moved on each landing, to bring the cage to that landing. When inside the cage the correct switch or button must be moved for the landing required.

With the collapsible gate system the gate is kept shut until car arrives at that opening, at which time a bolt may be automatically depressed so as to unlock a slide bar and allow the gate to be opened. Moving the cage away again locks the collapsible gate in position until the cage again reaches that level.

II. Middle or Intermediate Backshaft Scrolls, Carrier Pulleys, and Draw Bands.

(*a*) The scroll guard must cover the top and front (wheel-gate side) of the scroll over its entire length and

(*b*) Be provided with flanges at each side to cover completely the sides of the scroll and any key or other projection on it, and

(*c*) The space between the backshaft and the holes in the flanges,

through which the shaft passes, must be small enough to prevent the fingers being inserted.

(*d*) The guard for the draw bands and carrier pulleys must be continued from the scroll-guard to the floor at the front, back, and sides, to enclose completely the draw bands and carrier pulleys. The openings in front (near the floor level) for the passage of the bands, and those at the sides for the purpose of lubrication must not permit access to the nip between the carrier pulleys and the bands.

III. End Scrolls and Draw Bands.

(*a*) The guard must cover the top, front, and bottom of the scroll over its entire length. The openings in front for the passage of the bands must not permit access to the nip between the scroll and the bands.

(*b*) The guard must be provided with flanges at each side to cover completely any key or other projection on the scroll. The flange on the inner side to extend from the top to the bottom of the guard, and that on the outer side to extend from the top and bottom of the guard to the frame end.

(*c*) The space between the backshaft and the hole in the inner flange, through which the shaft passes, must be small enough to prevent the finger being inserted.

It shall be the duty of the persons employed to observe Part II. of these regulations, but it shall be the duty of the occupier, for the purpose of enforcing their observance, to keep a copy of the regulations in legible characters affixed in every mule room, in a conspicuous position where they may be conveniently read.

Part I.

Duties of Occupiers.

3. After 1st January, 1906, the following parts of every self-acting mule shall be securely fenced as far as is reasonably practicable, unless it can be shown that by their position or construction they are equally safe to every person employed as they would be if securely fenced.

(*a*) Back shaft scrolls and carrier pulleys and draw band pulleys.

(*b*) Front and back carriage wheels.

(*c*) Faller-stops.

(*d*) Quadrant pinions.

(*e*) Back of head-stocks, including rim-pulleys, and taking-in scrolls.

(*f*) Rim band tightening pulleys, other than plate wheels, connected with a self-acting mule erected after 1st January, 1906.

PART II.

Duties of Persons Employed.

4. It shall be the duty of the minder of every self-acting mule to take all reasonable care to ensure :—

(*a*) That no child cleans any part or under any part thereof whilst the mule is in motion by the aid of mechanical power.

(*b*) That no woman, young person, or child works between the fixed and traversing parts thereof whilst the mule is in motion by the aid of mechanical power.

(*c*) That no person is in the space between the fixed and traversing parts thereof unless the mule is stopped on the outward run.

5. No self-acting mule shall be started or re-started except by the minder or at his express order, nor until he has ascertained that no person is in the space between the fixed and traversing parts thereof.

CITY AND GUILDS' OF LONDON INSTITUTE, 1920.

SECTION A.—FINAL EXAMINATION IN COTTON SPINNING.

CARDROOM PROCESSES.

Saturday, 24th April, 2.30 *to* 6.30 *p.m.*

Attempt not more than *twelve* questions.

A limited number of best candidates in written Examination selected for viva voce Examination held shortly afterwards.

1. 25,000 lb. of cotton, containing 8 per cent. of moisture, are delivered to a mill, and it is used for the production of (*a*) 20's counts or (*b*) 80's counts. State the total weight of finished rovings that this cotton will produce, and give a very detailed statement of all the losses that may have occurred in, and are associated with the various processes through which the cotton has passed, up to, but not including, the spinning process. 20 questions given.

2. A comber is set and takes out 10 per cent. of waste from a certain class of cotton that has passed through the card, draw-frame, sliver lap and ribbon lap. If the same cotton is used and the same comber settings retained, state what you would consider to be the percentage of waste taken out by the comber if the cotton passed through the following systems of working :—

(*a*) card, sliver lap, ribbon lap, comber.

(*b*) card, sliver lap, comber.

(*c*) card, draw-frame, sliver lap, comber.

Give full reasons for any differences in the waste made.

3. How many rows of needles are there on the cylinder of a comber? Give the approximate number of needles per inch in each

row, for a half-lap intended for coarse and for fine work respectively. State where the greatest number of damaged needles are produced and explain fully the causes of the damage.

4. Assume that the cotton passing through the cardroom has $1\frac{3}{8}$ inch staple. Give what you consider to be the most suitable settings between the front and second roller in the following machines: draw-frame, slubber, intermediate, roving frame, ribbon lap, and comber drawbox. Reasons for your settings are to be set out in detail.

5. It frequently happens that one or more of the spindles on a bobbin and fly-frame are not being used. Give the causes of this unproductiveness, distinguishing those due to mechanical defects from those due to faulty organisation and supervision, and state how the faults are remedied.

6. What purpose is served in mixing different classes of cotton? State (*a*) what cotton can be mixed with Sakellarides, and (*b*) a cotton that will mix with Tinnivelly. Describe how you would make a mixing of (*a*) and of (*b*).

7. State the uses to which comber waste are put and describe what preparatory treatment it is put through before being spun. Give range of counts for which comber waste is suitable.

8. Who carries out the testing of bale cotton for moisture at the mill, and how often is such a test made? Also state who carries out all the usual tests on card, drawing frame and comber slivers, and on rovings. How often are these tests made? What are the objects of making the tests, and what percentage of variation would you consider permissible before making an alteration on the machine to correct any irregularity?

9. During a certain week, the Liverpool Cotton Association reports that 1,500 bales of African cotton were imported into Liverpool. Write a brief statement under each of the following heads: (*a*) Place or places of origin; (*b*) class of cotton, characteristics; (*c*) counts spun from such cotton.

10. A slubber hank roving is 1·3 and the twists per inch are 0·74.
An intermediate hank roving is 4·3 and the twists per inch are 1·62.
A jack frame hank roving is 12·7 and the twists per inch are 3·5.
Calculate the multiplier for twist for each frame and explain clearly why the multiplier is different in each case. Also state the kind of cotton for which these multipliers would be used.

11. If irregularities are occurring in the finished lap of a ribbon lap machine, describe how you would proceed to find out the cause and how you would remedy the faults.

12. Sketch and describe a modern saw gin with its condenser, and state for what class of cotton it is most suitable.

13. If it were found necessary to increase or decrease the flat strip waste on the card, what means would you adopt to effect this?

14. Long fibres are found in the waste of a comber. Explain how this can occur, and illustrate your answer by sketches.

15. Who is responsible for keeping the bobbin and flyer frames in good working order? What methods are adopted to correct (*a*) a difference in tension of the roving between the front and back row of spindles, (*b*) slack and tight rovings occurring at irregular intervals, (*c*) faulty skewer ends in the creels? Also explain clearly who is responsible for noticing these matters.

16. On what basis are the workpeople paid in the several departments of a cardroom:—

(*a*) Bale room, opening and scutching room.
(*b*) Cards and draw frames.
(*c*) Flyer frames combers, etc.?

Confine your answer to (*a*) or (*b*) or (*c*), and state the economic advantages or otherwise of paying by piece work or day work rates.

17. State what you consider to be the best practice in the renewal of the leather of rollers in cardroom machinery and also in the renewal of the flannel. Full details are required of the factors upon which you base your system of renewal.

18. In a mill producing 20,000 lb. of 100's counts combed yarns per weeks, give the number of sliver lap, ribbon lap and combing machines, that would be required. Give speeds, productions and other details on which you base your estimate.

Or

In a mill producing 80,000 lb. of 32's counts, give the number of draw frames and intermediate frames required, with full particulars of hank sliver, hank roving, speeds of front roller and spindles, number of ends, and number of spindles per frame.

19. The basis for deliveries of American cotton is officially described as "Fully middling with a low middling clause." Explain the meaning of this expression. Describe how you would proceed to obtain samples of cotton, examine them for defects, and ultimately purchase 30 bales of (*a*) American cotton, (*b*) Sea Island cotton.

20. In a mixture of fibres containing cotton fibres, short wool fibres, and short flax fibres, how would you distinguish the various fibres by a microscopical examination?

CITY GUILDS' EXAMINATION, 1920.

FINAL GRADE, SECTION B.—SPINNING AND SUBSEQUENT PROCESSES.

Saturday, 1st May, 2.30 to 6.30 p.m.

Twenty questions given, not more than *twelve* to be attempted. Answers to be illustrated, as far as possible, with clear sketches.

1. Describe the action of the traveller of a ring-doubling frame, and state its effect upon the yarn produced. State what differences you would expect to be produced between two doubled yarns of similar counts and qualities, produced under exactly the same conditions in all other respects, but one of which had been produced with a very light traveller, and the other with a heavy traveller. Give full reasons for any differences you describe.

2. Describe in detail how the fibres contained by two single yarns are affected by a folding twist which is in opposition to the twist contained by the singles. Describe also how the effects produced vary in degree according to the relative amount of twist in the single and two-fold yarns respectively. Illustrate your answer by giving examples of doubled yarns made with varying degrees of twist in the spinning and doubling processes in order to produce certain definite effects, stating the ultimate use of each type of yarn in each instance, and why the desired effect is necessary for the purpose specified.

3. State the various purposes for which yarns are "cleared," and describe the nature of the defects which are removed by this operation. Describe, with the aid of sketches, two different types of clearers, pointing out the advantages of each and its suitability for any particular purpose. In the case of cleared yarns which require to be "knotless," describe the methods adopted to make a knotless piecing.

4. Describe, with the aid of sketches, the leading features of any special type of twisting frame designed for the production of fancy yarns with which you may be acquainted. State what types of fancy yarns are produced with this machine, and describe how their special characteristics are obtained.

5. Describe in detail how you would make a comparative test of several samples of yarn submitted to you, in order to classify them in order of merit. Give full details of the methods and appliances you would use to ascertain the relative position of each sample in respect to the following properties, viz.: (*a*) elasticity, (*b*) the factor of irregularity in repect to strength, (*c*) the factor of irregularity in respect to evenness, (*d*) cleanliness and (*e*) spinning faults. It should be clearly understood that your answer must deal not only with the methods of making the tests, but also with

the method of collating the results of these tests in some form which will enable you to analyse each yarn and ascertain its value relatively to the others under comparison.

6. A large amount of cotton yarn is now used by the electrical trade for the insulating of copper wires. State the counts and qualities of yarns used for this purpose, and give details of the methods used in their production to obtain the best results. State also what special characteristics these yarns must possess to give satisfactory results for the purpose specified.

7. Enumerate some of the principal faults in yarns which detract from their value, stating the cause and remedy in each instance. Classify the defects under two heads, viz. those which are due to mechanical derangement or incorrect adjustment of the spinning machine and those which are due to inattention or carelessness on the part of the attendant, describing fully how you would discriminate between each type of defect respectively.

8. Assuming that you were in charge of the spinning department of a mill which was designed to spin up to 30's twist from American cotton, and it was desired to convert a portion of it for the spinning of 90's twist from Egyptian cotton, give full details of the changes you would make in the mules, assuming the alteration to be permanent. You are expected to give fully reasoned explanations for every alteration you suggest.

9. State which portions of a gassing frame require the most careful attention in respect to repair and adjustment, and describe the defects produced in the yarn by neglect of these details. Outline a scheme indicating how you would maintain gassing frames in good order, stating the period of time you would consider it safe to allow between the overhauling of the various parts to ensure keeping the machine in good condition and the product free from defects.

10. Describe some of the most common derangements in connection with the building of mule cops which are encountered in mill practice, and state how you would remedy them. Describe also how you would proceed to ascertain the cause of certain derangements from the appearance of the cop, giving full details of any features which are characteristic, and stating the nature of the defect in each instance. State also how you would distinguish between defects having their origin in the copping rail and plates, or other portions of mechanism respectively, giving full reasons for your answer and an example to illustrate your meaning.

11. Describe, with the aid of sketches, the Chapon or cup spinning frame for spinning waste yarns, giving full details of the manner in which the cop is built up. State what counts and qualities of waste are spun on this machine, and what special advantages it possesses for the purposes for which these yarns are used ultimately.

12. If you were arranging for the electrical driving of a room containing 10 pairs of mules, $1\frac{3}{8}$ inch gauge, 1,020 spindles in each mule, and for spinning counts from 40's to 90's from Egyptian cotton with the average spindle speeds usually adopted for this class of trade, state (1) what speed of line shaft you would adopt, assuming the motor to be direct coupled to the shaft, and (2) what horse power of motor you would select. Give full reasons for your answer, and state in detail how you would arrive at the power requirements of the drive. In estimating the power of the motor would you make any allowance over and above the actual power requirements of the mules for "fly-wheel effect"? If so, state how much and explain why this is necessary.

13. Describe in detail how you would organise the warehouse department of a mule mill spinning various counts and qualities of yarn in respect to the handling of the yarn from the spinning rooms up to the time when it was made up ready for delivery. Give full details of the system you would adopt to check the various weights; state what books you would keep, and the method of entering up you would use to enable full details to be kept of every consignment of yarn delivered, in order that any subsequent complaints could be traced to their source. Give full details also of the methods you would adopt to prevent mixing of the different counts and qualities of yarn.

14. Describe in detail the measures necessary to obtain the greatest efficiency from the drafting action of the mule or ring frame. State how the methods of drafting vary in accordance with the nature of the material operated upon, giving reasons for your answer. State also the circumstances under which loose boss top rollers, solid top rollers, and self-weighted top rollers give the best results respectively, giving full reasons in each instance, and stating how the setting of the drawing rollers is affected by the type of top roller used.

15. Sketch and describe the thread-locking arrangement of the twiner mule, giving full details of the manner in which it is adjusted and controlled. State what defects are produced by faulty action or adjustment of this motion, describing the derangement to which each defect is due and the remedy to be applied in each instance.

16. The cost of production in the spinning department of a mill may be increased by three factors, viz.—

(*a*) An increase in the rate of wages paid.
(*b*) A reduction in the number of hours worked, and
(*c*) By increasing the share capital.

Describe in detail how each of these factors, considered separately, affects the cost of production, stating the principal factors affected by each factor respectively, and showing by means of an example

the method in which you would deal with each in your costing scheme to ascertain the net increase in cost per lb. of yarn produced.

17. State what improvements have been effected in recent years in the artificial lighting of spinning rooms, both mule and ring. State what system of lighting is now mostly used, describing how it is applied and controlled, and what precautions are necessary in connection with its use to reduce the risk of fire to a minimum.

18. Describe, with the aid of sketches, how you would apply a double speed arrangement to an existing mule, giving details of the manner in which it is operated and controlled. Show by means of a calculation how much the spindle speed and the weekly production would be increased by the application of this motion as compared with the previous conditions. You may assume any type of mule and counts of yarn you are acquainted with, but must give full particulars of speeds, time in seconds per draw, and all necessary dimensions of pulleys, etc., for the conditions presumed to be obtained both before and after the alteration.

19. A mule of 1,000 spindles is spinning 60's twist with a spindle speed of 8,000 R.P.M., and putting in 28 turns per inch. The rim pulley is 17 inches in diameter, and the length of strecth 64 inches. The backing-off and taking-in are driven independently from the counter shaft by a band pulley of 13 inches diameter, and the time occupied in backing-off and taking-in is 4 seconds per draw.

Find (1) the number of seconds required to make one complete draw; (2) the production in lb. per week of 48 hours, allowing 7 per cent. loss for doffing, cleaning, etc.; (3) the effect upon each of the above two factors if the rim pulley is increased to 18 inches diameter, and the pulley driving the backing-off, and taking-in is reduced to 12 inches diameter.

20. A ring-doubling frame is geared up as follows: A wheel of 20 teeth on the tin roller shaft, drives a stud wheel of 90 teeth, with which is compounded the bottom twist wheel. The latter, through two carrier wheels, drives another stud wheel of 50 teeth, with which is compounded the top twist wheel, which in turn drives a wheel of 50 teeth on the bottom roller. The bottom roller is $1\frac{3}{4}$ inches diameter, and the tin roller is 10 inches diameter, and the spindle warve is 1 inch diameter.

Find the constant number for twist, and show how you would use it to find both change wheels to give 30 turns per inch.

CHAPTER X.

DEVELOPMENT OF COTTON TRADE.

The Factory System.

In the days of Hargreaves—of spinning jenny fame, of Arkwright and his continuous throstle spinning frame, and of Crompton with his spinning mule—1764 to 1780, the cotton trade of Lancashire was already an exceedingly large and important industry.

Living in Bolton for many years, the author has been very frequently in contact with features associated with the above inventors and their machines. Baines, Ure, French, and other writers recorded many particulars about the early days of the cotton factory system and the success attained by hand spinning and hand-loom weaving in the homes of the workers or in comparatively small workrooms. The continued demand for cotton yarns and cloths, led to the invention of the larger, more automatic, and much more productive machines, beyond the capital and enterprise of many individual small owners. In the present cotton districts of Lancashire, centring in Manchester there is evidence of the spinning and weaving of cotton as far back as the sixteenth century. During the war the present author had frequent converse with one or two old weavers who were even then weaving quilts on wide hand-looms and making it pay owing to war circumstances, although within sound and sight of some of the largest and best quilt-making sheds in the world.

When Arkwright and Crompton's machines were invented, fustian, check, smallware, and various cotton cloths were woven in good quantities, there being also many bleachers or "whitesters" even as now.

There is abundant evidence that in Arkwright's time there were both large and small employers who engaged workers by making the necessary connections and finding the money in connection with raw wool and cotton, spun yarn, woven cloth, bleaching, collection, and distribution, and such machinery as was in use.

For several centuries the textile trade has dominated many of the Lancashire districts, for a long time wool being very prominent but later on cotton obtaining absolute supremacy in most Lancashire districts, while wool centred more and more in Yorkshire. Such border towns as Rochdale and Mossley have for more than 100 years had cotton mills adjacent to woollen mills.

At different times the author has examined empty old woollen mills in the cotton districts, often owned and kept empty by some employer on account of water rights.

It has been stated that silk and wool factories existed in the English textile districts before cotton factories, but following the inventions of Kay, Crompton, and Arkwright, the cotton mills exceeded in size and magnitude either silk or wool.

Manchester itself was a relatively important producing centre and was always a marketing, assembling, and distributing centre, although later on for actual spinning, weaving, bleaching, and dyeing, the actual industries centred more and more in Bolton, Oldham, Stockport, Stalybridge, Darwen, Blackburn, Burnley, and adjoining villages. Manchester goods were already celebrated abroad before Crompton and Arkwright's inventions; and the factory system already existed, but very soon multiplied enormously, both size and number of mills increasing. Mayalls, & Buckley's of Mossley, Woods of Glossop, the old Four Factories of Bolton, and many mills about 100 years old are still in active working, although under different ownership. Such mills have often length enough even for these days, but are mostly too narrow for modern spinning mules, and have therefore been converted to ring-spinning or else have had the mules placed to run lengthways of the rooms.

London has long since lost its original importance as a centre for raw cotton or cotton goods, Manchester remaining the greatest market and centre for yarn and cloth, with Liverpool supreme for raw cotton. An old student of the present author's—Mr. Alfred Holt, was for some time manager at a Bristol cotton mill, another is the employer at a cotton mill in Belfast, and a friend many years ago, was overlooker at a cotton mill in Hull; but this idea of odd cotton mills in different centres does not increase in favour.

Prior to Arkwright's time many producers bought a certain amount of cotton or wool, and at home—sometimes mixed up with other work—carded and spun the cotton into yarn and then either sold the yarn or wove it into cloth before selling. Firwood Fold—the birthplace of Crompton, and Hall-ith-wood, at which place Crompton invented the hand-mule—are typical places for doing such work. These two places, after the lapse of 140 years are still in active tenancy, scarcely a quarter of a mile apart, in the

Tonge District of Bolton. Hall-ith-wood has been renovated and converted into a museum through the generosity of Lord Leverhulme, himself born and bred in Bolton. One hundred and sixty years ago cotton cloth was produced both as a home industry on independent lines, and also under the employer's system of a person doing so much work for so much stipulated payment.

Many textile workers 150-170 years ago, although apparently more independent because they did the work at their own homes, were almost as much fast to employers as under the factory system.

Judging from his personal investigation and from reading it would appear that in Samuel Crompton's household there was a mixing up of farming, spinning, weaving, and other occupations, it being stated that Crompton also played the fiddle at the Bolton Theatre.

Strikes and Trade Unionism existed in the Lancashire textile trade on much the same fundamental principles as to-day, even before Arkwright's time, and the inventions of Kay, Hargreaves, Arkwright, Crompton, and others, were causes of great disturbances amongst textile workers who thought the greater productiveness of the new machines would mean fewer people employed. Short credits largely rule in these days in Lancashire both for cotton and yarn.

In Arkwright's time and before there were Manchester and other men with sufficient capital who sold small quantities of cotton on long credit to small spinners, enabling the latter to produce yarn before paying for cotton. Even in 1922 this has been done with C.I.F. cotton but requires a good deal of smartness.

Even in the older times the spinners would purchase larger quantities of cotton on short credit or for cash whenever their means permitted this.

The great war of 1914-18 has disturbed the cotton industry very greatly indeed, but not more so proportionately than did the Napoleonic wars which culminated in the Battle of Waterloo in 1815.

The Cotton Trade 100 *Years Ago.*

There are various publications to which reference may be made in considering the development of the cotton trade. The brief survey in this chapter is chiefly based on Dr. Ure's books.

Published about 1836 and extended about 1861 by Mr. Simmonds, the two volumes of Dr. Ure on the cotton trade have continuously received attention and respect from interested readers.

Comparative Table.	1835.	1859.
"Population of Great Britain . .	17,564,138	27,435,325
„ of Manchester . . .	170,000	450,000
Cotton production U. States, bales .	1,254,328	4,000,000
Cotton imported into Great Britain, lb.	363,702,963	1,225,989,184
Cotton worked up in ditto . . .	333,043,464	1,050,846,048
Cotton manufactures exported, declared value	£22,128,304	£48,208,444
Cotton manufactures consumed in the United Kingdom, estimated . .	£29,504,405	£64,277,925
Capital embarked in cotton industry in England.	£35,000,000	£60,000,000
Spindles at work in United Kingdom	9,350,000	33,000,000
No of persons employed in cotton factories in ditto	216,858	447,000
Aggregate value of the gross imports of the United Kingdom . .	£48,911,542	£180,000,000
Aggregate value of exports of British produce and manufactures . .	£47,372,270	£130,440,427
Revenue of the United Kingdom .	£51,347,320	£66,070,469"

The progress shown here has, no doubt, been materially accelerated by the removal of all duties on the raw material, which until 1845, had been 2s. 11d. per cwt. on foreign, and 4d. on British cotton. Ure, Appendix.

The enlarged Vol. I. contains a list of patents for the cotton trade extending from 1800 to 1860, comprising a list of over 1,200, patents to which reference is made, and covering doubling, spinning, reeling, preparing, dressing, manufacturing, twisting, combining machinery, roving, slubbing, cards for carding, cards, making rollers, singeing, grinding spindles, cleaning, drawing, throstle spinning, mules and billeys, scribbling, conveyance of cotton to mules and throstles, machinery for roving, cylinders for carding cotton, fibres as substitutes for cotton, improved covering for rollers, doubling cotton, spindles and flyers, ginning machinery, presser flyers, cop tubes, winding weft, cleansing mill sweepings, driving spindles, bolsters and washers, condensing apparatus, self-acting willow, sliver cans, pressure to top rollers, speed indicators bobbins, cans, slivers, conductors, collars and footsteps of spindles, looms for weaving, frictional drag, improvements in dyeing cotton, warping yarns, supplying moisture to the air in factories, opening and cleaning. From about 1852 combing appears frequently in the list.

From the documents of the East India Co. it appears that during the period 1700 to 1760 cotton yarn was imported from India into Great Britain, reaching a maximum of about 220,000 lb. in 1707, some years none at all, and less than 3,000 lb. in 1760.

Dr. Ure says that in 1710 the total importation of cotton wool was 715,008 lb. The following tables are reproduced from Dr. Ure's treatise.

YARN FROM THE UNITED KINGDOM.

COUNTRIES.	1827.				
	Entered by the Yard.		Hosiery, Lace, and Small Wares.	Cotton Twist and Yarn.	
	Quantities.	Declared Value.	Declared Value.	Quantities.	Declared Value.
	Yards.	£	£	lb.	£
Russia	4,258,508	155,932	23,704	12,070,675	933,204
Sweden	65,569	2,620	820	250,290	18,365
Norway	214 400	8,386	1,200	9,294	599
Denmark	270,338	8,288	505	265,824	19,064
Prussia	20,543	1,006	626	55,779	4,888
Germany	43,675,688	1,539,826	205,495	17,028,354	1,351,508
Holland, Belgium	13,734,445	550,587	281,347	6,295,493	580,937
France	365,100	16,055	7,906	15,722	1,580
Portugal, Proper	25,472,135	733,546	16,874	193,456	16,253
,, Azores	385,583	11,604	185	—	—
,, Madeira	388,942	12,542	589	13	2
Spain and the Balearic Islands	340 516	14,546	1,246	21,365	1,591
,, ,, Canaries	638,571	25,297	758	1,048	108
Gibraltar	17,202,891	593,131	19,233	105,262	8,866
Italy and the Italian Islands	28,113,538	905,330	27,641	4,457,476	267,920
Malta	3,275,227	100,297	1,344	250,794	13,267
Ionian Islands	105,894	3,757	167	11,952	990
Turkey and Continental Greece (exclusive of the Morea), Morea and Greek Islands	11,560,172	364,108	570	647,094	39,694
Egypt (Ports on the Mediterranean)	1,966,654	48,715	50	—	—
Tripoli, Barbary, and Morocco	183,395	4,666	—	1,500	70
Western Coast of Africa	1,026,584	41,870	208	50	12
Cape of Good Hope	1,748,556	60,838	7,105	2,182	289
Cape Verd Islands	—	—	—	—	—
St. Helena	44,932	1,824	157	112	12
Isle of Bourbon	—	—	—	—	—
Mauritius	1,696,516	67,435	5,482	—	—
East India Company's Territories and Ceylon	36,167,952	1,355,153	40,993	3,063,556	273,990
China	1,581,353	66,345	935	300	25
Sumatra and Java	2,342,207	87,987	1,697	—	—
Philippine Islands	887,244	36,902	2,791	—	—
New South Wales, Van Diemen's Land, and Swan River	1,105,957	41,309	4,900	3,813	370
New Zealand and South Sea Islands	—	—	—	—	—
Ports of Siam	—	—	—	—	—
British North American Colonies	6,616,812	224,467	13,875	35,568	2,200
British West Indies	26,730,096	888,661	51,202	7,680	744
Hayti	4,288,244	145,085	2,763	—	—
Cuba and other Foreign West Indies	9,779,788	360,300	14,801	—	—
United States of America	52.856,809	2,257,955	269,075	8,914	1,547
Mexico	13,687,021	507,336	28,235	9,460	1,068
Guatemala	9.174	400	150	—	—
Columbia	3,987,030	139,322	6,472	110	40
Brazil	37,195,322	1,119,344	39,600	8,961	2,145
States of the Rio de la Plata	2,076,897	69,527	6,159	25,208	761
Chili	5,825,700	203,722	27,349	13,846	1,509
Peru	2,917,056	114,866	14,977	14,040	1,501
Isles of Guernsey, Jersey, Alderney, and Man	683,445	57,148	15,366	3,583	459
Total	365,492,804	12,948,035	1,144,552	44,878,774	3,545,578

COUNTRIES.	1853.				
	Cotton Manufactures. Entered by the Yard.		Hosiery Lace, and Small Wares.	Cotton Twist and Yarn.	
	Quantities.	Declared Value.	Declared Value.	Quantities.	Declared Value.
	Yards.	£	£	lb.	£
Russia, Northern Ports	1,283,163	27,613	4,981	2,290,800	137,324
,, Southern Ports	422,873	5,550	100	103,470	4,186
Sweden	—	—	—	1,278,307	45,295
Norway	1,041,978	18,428	—	620,021	25,399
Denmark	2,022,734	26,717	—	1,842,498	64,142
Prussia	—	—	—	765,123	26,508
Hanover	—	—	—	2,975,930	146,795
Hanse Towns	43,939,399	782,654	201,671	41,742,609	2,076,717
Holland	27,478,269	472,374	81,342	30,034,746	1,692,043
Belgium	2,232,919	59,613	56,778	3,159,880	179,676
Channel Islands	2,025,982	46,066	—	—	—
France	2,859,614	64,836	57,360	126,102	43,584
Portugal and Isles	53,141,514	671,695	8,170	1,046,038	43,468
Spain and Canaries	6,562,422	32,917	3,927	—	—
Gibraltar	25,949,568	369,729	21,801	—	—
Sardinia	14,760,427	240,654	16,526	1,341,831	46,775
Tuscany	17,481,559	234,710	25,034	3,468,285	104,742
Papal States	5,378,270	80,219	—	2,462,086	78,740
Two Sicilies	9,206,357	147,272	12,798	5,762,964	199,630
Austrian Territories	14,704,917	199,476	5,252	4,121,081	135,113
Malta	9,104,108	107,687	—	874,698	30,447
Ionian Isles	4,715,521	66,655	—	628,718	18,411
Greece	5,600,691	95,510	—	354,194	12,161
Turkey	101,100,341	1,506,897	12,092	4,665,467	158,368
Wallachia and Moldavia	6,385,037	77,155	—	2,198,493	75,332
Syria and Palestine	19,353,068	242,235	—	1,066,835	33,430
Egypt	25,379,111	317,966	6,401	875,073	27,795
Barbary States	4,202,030	58,687	—	—	—
West Coast of Africa	23,975,234	383,894	—	—	—
South African Colonies	11,629,099	204,905	10,621	—	—
Mauritius	8,667,973	122,810	4,515	—	—
British India	357,281,200	4,456,780	54,249	26,131,675	1,168,264
Eastern Islands	49,879,409	743,617	13,537	712,951	30,344
China and Hong Kong	98,602,583	1,205,561	2,011	5,234,617	198,485
Australia and South Sea Islands	38,045,234	853,084	197,364	—	—
British North America	44,470,200	845,291	60,161	632,384	23,456
British West Indies	22,609,293	442,284	24,075	—	—
British Honduras	3,603,753	51,636	—	—	—
Cuba	19,718 858	339,607	42,702	—	—
Foreign West Indies	20,440.729	271,472	11,991	—	—
Hayti	3,755,253	73,134	1,654	—	—
United States	193,328,908	3,607,608	655.515	—	—
Mexico	32,989,639	469,080	47,555	493,155	11,719
Central America	7,940,958	114,388	1,849	—	—
New Granada	18,755,837	279,453	11,721	—	—
Venezuela	10,431,458	151,060	4,068	—	—
Ecuador	824.364	13,606	—	—	—
Brazil	116.792,581	1,727,388	60,009	—	—
Uruguay	15 669.466	251,181	8,551	—	—
Buenos Ayres	15,389,230	237,023	14,481	—	—
Chili	35,409,389	541,766	45,599	—	—
Peru	39,173.666	621,040	33,299	—	—
Other Countries	6,746 101	132,967	67,862	1,192,320	57,304
Total	1594,592,659	23,901,940	1,915,309	147,539,302	6,895,653

Welfare.—"Employment in a cotton mill may be and generally is, as salubrious as any other which the children of labour can obtain in the present state of the world. I should wish, however, to see warm baths attached to every factory. They could be supplied without trouble or expense with the pure hot water discharged from the steam pipes which traverse the apartments. A set of such baths for males, and another for females, at opposite sides or ends of the building, each kept in order by a superannuated man and woman, who would receive a trifle from each bather for their attendance, would conduce greatly to the cleanliness, health, and comfort of the operatives."—(Ure, 1836.)

Foreign Competition.—"The paralysis of our factories during a strike is the immediate cause of the erection of rival factories in other countries. The foreign market gets bare, prices rise, and draw capitalists into the empty channels. The discontented workmen migrate to other countries, and sow the seeds of opposition. Every strike in Great Britain has been the era of new factory creations abroad. During the disastrous strike in Lancashire and Lanarkshire of 1829, many of our spinners who were prevented from working, went to France, Belgium, and the United States. . . .

". . . Goods suffer an undue depreciation when they are produced during a stagnation in trade, and the manufacturers are unwilling to dismiss good workmen who could not be readily replaced at the time of the revival, and they often also continue to employ them from feelings of humanity. . . ."—(Ure, 1836.)

Alsatian Productions.—"I have seen a machine in Alsace which cards, draws, and rovers cotton waste, for low numbers of yarn, with an economy of labour and time truly marvellous, and unequalled, I believe, in any part of Great Britain. . . .

"The bobbin and fly-frames of 200 spindles each constructed and mounted in M. Schlumberger's factory, are, I believe, the most productive machines of their kind in existence. . . .

"The fluted drawing rollers are peculiarly beautiful, and, as well as the spindles, fetch a higher price all over France, than those imported from England.

"M. Schlumberger's mules have 396 spindles, and spin everything from no. 20 up to no. 230 English. On counting the time of a stretch of both 130's and 150's English, I found them to be exactly 52 seconds each, the stretch length being 52 inches."—(Ure, 1836.)

Cotton.

"The wool-bearing shrub called gossypium, by botanists. . . . This singular class of plants has been largely distributed all over the torrid zone, a conspicuous gift of providence to its inhabitants,

destined to afford them, in its fleecy pods, a spontaneous and inexhaustible supply of the clothing material. . . .

"No sooner does the cotton plant arrive at maturity than its swollen capsules burst, with an elastic force, in three or five gaping segments, in order as it were, to display to the most careless eye their white fleecy treasure, and to invite the hand of the observer to pluck it from the seeds, and to work it up into a light and beautiful robe.

"The earliest accounts given by travellers among the intertropical nations, show them to have been acquainted with the fabrication of cotton cloth. Of all textile materials, cotton is the most easy to twist into a fine thread, a process which may be performed upon the plucked filament by the fingers and thumbs alone. How readily these threads may be converted into a web, the simple weaving machine of the Hindoo sufficiently attests.

". . . Herodotus, who wrote upwards of four centuries before the reign of Augustus, notices distinctly the cotton fabrics of India, and says that a species of plant in that country bears a fruit full of a wool superior to that of sheep, with which the natives make cloth for their garments."—(Ure, 1836.)

"The town of Manchester buys the linen yarn of the Irish in great quantity, and weaving it, returns the same in linen into Ireland to sell. Neither does her industry rest here, for they buy cotton wool in London, that comes from Cyprus and Smyrna, and work the same into fustians, vermillions, and dimities, which they return to London, where they are sold."—(Lewis Roberts, 1641.)

India.—"It is in spinning the more tenacious warp yarn that machinery has the greatest advantage over the hand, and accordingly it was that description called twist that first found its way from this country into India. In 1815, the small quantity of 8 lb. was sent out on trial, and in the same year the importation of British white and printed cotton goods into India amounted to nearly 800,000 yards. In 1845 the amount was 45,000,000 yards

"In 1824 only 121,000 lb. of British yarn was taken in India for their looms and five years later this became twenty-five times as great."

"The average price of twist yarn imported into India in 1829 was 1s. 3¾d. per pound."—(Ure, 1836.)

Foreign Names for Cotton.

"The following names have been give to cotton in different languages:—

Greek . . .	Bombyx, Xylon.
Latin . . .	Gossypium, Bombax.
Italian . . .	Cotone, Bombagia.

Georgian	Bomby, Bamba.
India	Kopa, whence the English term *cop* for a pirn of cotton yarn.
French	Cotonnier for the plant, Coton for the wool.
German	Kattunwölle, Baumwölle.
Dutch	Kétoen, Boomwol.
Danish	Bomold.
Swedish	Bomull.
Spanish	Algodon.
Portuguese	Algodno, Algodeiro.
Russian	Bomaga, Chloptscha taja.
Mongul	Kobung.
Chinese	Cay-Haung, Hoa-Mien."

—(Ure, 1836.)

Cotton Values.

"The relative value of different cottons is exactly represented in the table of prices current, published by the brokers. Thus at Liverpool, on the 1st December, 1835, the best cottons of each name were sold at the following prices per pound, duty paid :—

	s.	*d.*		*s.*	*d.*
Sea Island	1	6	to	2	6
Demerara and Berbice	0	9	„	1	0
Pernambuco	0	10¾	„	1	1½
Egyptian	0	11½	„	1	2½
New Orleans	0	7⅛	„	1	0
Bahia	0	8½	„	0	10
Upland Georgia	0	7⅛	„	0	11½
West Indian	0	7¾	„	0	9
Surat	0	6⅛	„	0	8
Madras	0	6½	„	0	8
Bengal	0	5¼	„	0	6½

"This order of price and value has remained with slight exceptions, nearly uniform for the last twenty-five years."

". . . The following are the most common distinctions of cottons recognised on the Continent of Europe: (1) the North American; (2) the West Indian; (3) the South American; (4) the East Indian; (5) the Levantine; (6) the African; (7) the Italian; (8) the Spanish."—(Ure, 1836.)

Cotton Botany.—In 1835 Dr. Ure was favoured by papers from American cotton planters, from which the following remarks are culled :—

Cotton Grown in the United States.

"1. The herbaceum, having a smooth stalk 2 feet high, branching upwards, with five lobed smooth leaves, and yellow flowers at

the end of the branches ; the flowers being in harvest time replaced by roundish capsules full of seed-cotton.

"2. The hirsutum, or hairy American cotton, has hairy stalks branching laterally, 2 or 3 feet high, palmated three and five lobed leaves, with yellow terminal flowers, replaced by large oval pods filled with seed-cotton.

"3. The Barbadense, or Barbadoes shrubby cotton. It has a shrubby stalk, branching 4 or 5 feet high, three lobed smooth leaves, glandulous underneath, with yellow flowers, replaced by oval pods filled with seed-cotton.

"4. The arboreum, or tree-cotton, has an upright, woody, perennial stalk, branching 6 or 8 feet high, palmated four or five lobed smooth leaves, with yellow flowers filled with seed-cotton.

"The seeds of the first and second varieties, besides the proper filaments of cotton-wool which invest them, are covered entirely in the second, and partially in the first, with a dense short fur, resembling closely the under-fur of a hairy animal."

"*Rain and Insect Damage.*—The month of August is a period of great solicitude to the cotton grower, as the heavy rains frequently cause the plant to part with its fruit and even its leaves ; the August full moon is likewise the time when the caterpillar makes its appearance. It is the offspring of a small brown moth, which deposits its eggs upon the leaf of the gossypium always a night or two before the full or new moon ; they hatch in a few hours after being deposited, and are so small at first as to be scarcely discernible to the naked eye ; they do little or no damage for the first nine or ten days of their life, like the silk-worms, eating little in their infancy ; but a few days before they complete their growth they become so excessively voracious as to destroy an entire plantation in a few hours.

"Experience has led to the belief that these caterpillar ravages may be expected once in seven years. . . .

"When cotton fields have escaped injury from rains, winds, and worms, they display as beautiful a scene as the admirer of vegetable nature could desire to behold ; wide wavy groups of viny foliage blended with three-coloured blossoms of brilliant hues, and pods of darker shades in various states of ripeness. When the flower comes forth it has a fine yellow colour, which it retains during the first day, under the influence of the night it changes to a red or crimson hue ; in the third day it darkens to a chocolate brown, and then falls to the ground, leaving a pod already ½ inch in diameter. The cotton pods begin to ripen about the 1st of August from which time to the 1st of December, the whole attention of the cultivator is devoted to the picking-in of the cotton as the pods daily open." —(Ure, 1836.)

Ginning.—"No sooner was the attention of the Southern States

excited towards the culture of cotton as a profitable branch of industry, than it began to spread from the seashores to the interior, but a great difficulty then arose from the adhesion of the fibres to the hairy green seed, which was not overcome until Whitney and Miller's saw-gin became known. The hairy cotton had obtained the preference over the others upon the inland grounds of Georgia and Carolina, because the wool, though shorter in the staple, was much stronger, and came to maturity at an earlier period in the autumn. The simple roller gin, which answered so well for the ginning of the bare black seed of the longer staple, was quite ineffective for the short staple because the fur upon the seed stuck to the rollers, and obstructed the entrance of the proper filaments.

"But, wherever Whitney's machine became known it was laid hold of with avidity and with little regard to the patent privilege of the inventor. Whitney's saw-gin was invented in 1793, and was first mounted on a good scale at Mr. Millar's plantation, 16 miles above Savannah in the year 1795.

"This gin acts perhaps a little too roughly on the fibres, tearing a few, and causing a loss of about one-sixth of the wool when compared in its product to that of the roller gin applied to the Sea Island cotton. The saw-gin of sixty wraggs or saws ought not to make more than from 600 to 800 lb. of clean cotton in 12 hours.

'Henceforth the short-stapled cotton began to be grown in all directions round Georgia as a common centre: north into the two Carolinas, west into the hill country, and into all the Southern States, accommodating itself to the different soils and climates, but of better quality when raised near the sea, and thriving best in alluvial soils, a little impregnated with salt, as in some of the districts of Louisiana."—(Ure, 1836.)

"*Seed-Cotton*" "*Seed*" *and* "*Lint*."—"Mr. Spalding states that 1,000 lb. of seed-cotton equal to 250 lb. of ginned wool, may be raised with reasonable diligence from an English acre of the best lands, but only half this amount in some of the hill country lands. . . .

"There is no plant which requires rotation of crops more than the cotton, and there is no country where that practice is more important than in the Southern States.

"The seed when sold for fodder fetches about a dollar the 30 or 40 bushels. The cattle are very fond of it, but unless it be mixed with dry fodder, such as husks or leaves of maize in order to dilute it, and prevent the cotton fibres from balling in the stomach, it has a scouring effect, and is reckoned unwholesome."

The Increase in the Growth of Cotton in the United States.

COTTON EXPORTED.

Years.	Bales of 300 lb.	
1794	5,340	
1795	20,901	
1796	20,355	Nearly all the crops were exported in this period. In 1795 and 1796, some foreign cotton was included in the returns of exports.
1797	12,628	
1798	31,200	
1799	31,774	
1800	59,299	
1801	67,700	Slave population in 1790 . . 697,000
1802	91,670	1800 . . 896,000
1803	137,018	
1804	127,060	
1805	127,966	
1806	122,225	These are the quantities exported and probably include nearly the whole growth, except during the years 1812 and 1814, the period of war between Great Britain and the United States.
1807	213,148	
1808	35,434	
1809	169,934	
1810	310,871	
1811	206,860	
1812	96,291	
1813	62,030	Slave population in 1810, 1,191,000.
1814	59,094	
1815		
1816		
1817		
1818		These are accurate, and represent the entire crops.
1819	303,589	
1820	369,800	
1821	539,038	Slave population in 1820, 1,538,061.
1822	588,139	
1823	509,600	
1824	560,000	
1825	710,000	
1826	937,000	
1827	712,000	
1828	857,000	
1829	976,845	Entire crop.
1830-1	1,038,847	Slave population in 1830, 2,010,436.
1831-2	987,477	
1832-3	1,070,438	
1833-4	1,205,394	
1834-5	1,254,328	

(Ure 1836.)

IMPORTS OF EGYPTIAN COTTON WOOL.

	London.	Liverpool.	Glasgow.	Total in Great Britain.	Sale Price, 31st Dec. per lb.
	Bales.	Bales.	Bales.	Bales.	*d.*
In 1823	1,277	1,173	—	2,450	$11\frac{1}{4}$
1824	10,645	22,622	580	33,807	$10\frac{3}{4}$
1825	21,831	80,736	631	103,198	$10\frac{1}{2}$
1826	8,115	38,218	—	46,333	8
1827	4,988	14,420	2,310	21,728	8
1828	3,820	24,702	2,616	31,138	$7\frac{3}{4}$
1829	1,980	22,425	—	24,405	$6\frac{7}{8}$
1830	700	11,019	1,865	13,584	9
1831	8,540	26,487	1,050	36,077	$8\frac{1}{2}$
1832	2,837	32,271	5,109	40,217	$8\frac{3}{4}$

The freight from Alexandria to this country is about $\frac{3}{4}$d. per lb. The Makò is a cotton compared by some spinners to the Brazil.

Estimate of the probable Growth of Cotton in the World (exclusive of China), from the principal Cotton Countries, for 1835-36.

	Bags and Bales of 340 lb.
India	400.000
Brazils and the West Indies	200,000
America	1,300,000
Egypt	50,000
Levant	70 000
	2,020,000

COTTON—GREAT BRITAIN AND THE CONTINENT.

	Imports.		Stocks.	
	1833.	1834.	1833.	1834.
Great Britain	930,270	949,020	215,130	185,560
Hamburgh	22,700	45,188	1,985	4,500
Bremen	3,530	6,814	345	1,406
Amsterdam	7,915	13,532	1,290	1,418
Rotterdam	13,862	43,785	1,504	200
Antwerp	24,120	24,124	4,500	2,480
Havre	210,600	201,600	33,920	22,000
Bordeaux	3,944	6,682	81	95
Marseilles	74,544	48,938	12,780	1,063
Genoa	13,960	15,900	2,077	1,467
Leghorn	1,200	1,950	None	None
Trieste	61,847	53,193	12,538	6,375
	1,368,492	1,410,726	286,150	226,564

(Ure, 1836.)

"*Former Transport by Canal.*—In the year 1760, just before the Bridgewater Canal was completed, the shipping cleared out of the British ports amounted to 471,241 tons. In 1790, when a great part of England was intersected by canals, after the example of the Bridgewater enterprise, the tonnage had become 1,379,329, being very nearly trebled.

"Canals are, in fact, a contrivance to enable one horse to transport as great a lot of merchandise as thirty could do on a good road, or fifty horses on an indifferent road. And how expensive are roads to maintain in comparison to canals. Brindley said the main use of rivers was to supply canals with water. The water-ways of England now radiate from six central points, Manchester, Liverpool, Birmingham, Hull, London, and Bristol, furnishing such easy commercial transport that each of these emporia of trade participates in the ingenuity and opulence of all adjacent counties. The railways now in course of construction in so many parts of Great Britain, will form an invaluable complement to canal navigation and render the whole island one continuous and compact mart of industry."—(Ure, 1836.)

Cotton as a Domestic Industry.—"The workshop of the weaver was a rural cottage, from which, when he was tired of sedentary labour, he could sally forth into his garden. The cotton wool which was to form his weft was picked clean by the fingers of his younger children, carded and spun by the older girls, assisted by his wife, and the yarn was woven by himself, assisted by his sons.

"When he could not get sufficient yarn for his looms he had recourse to spinsters of his neighbourhood. One good weaver could keep three active women at work upon the wheel spinning. Weft and looms were often stopped for yarn. Things appeared to jog along in this precarious state for possibly a century until about 1760. Then new marts for profitable export having presented themselves in Germany, Italy, and the Northern American colonies, the merchants realised the greatest obstacles to production lay in the difficulty of getting sufficient yarn.

"A mighty fermentation seems, in consequence, to have taken place all over Lancashire at this time and many projects were devised to remove this grand barrier to fortune. . . .

"The first mechanical invention regularly employed with profit upon a manufacturing scale for spinning cotton in England was constructed upon the principle of the big wheel or hand spinning wheel used from time immemorial so that the big wheel revolved by the spinner would give many revolutions to the twisting spindle, and later termed the jersey wheel, useful alike for wool or cotton. The multiplying wheel or spinning Jenny was the invention of James Hargreaves and contained at first eight, and later eighty

spindles, all made to revolve from one large wheel or rim-pulley. At the same time a movable frame alternately receded from the spindles during the extension of the thread, and approached them in its winding-on. James Hargreaves was a weaver by trade at Standish, near Blackburn, and invented his machine about 1764."

The Mule Spinner.—Crompton learned to spin upon one of Hargreaves' original Jennies about 1769.

The Jenny necessarily contained the big wheel or rim-pulley, driving directly to the forerunner of the present tin rollers and which was able to drive as many individual spindles as required. Also it contained the equivalent of the present winding faller wire for guiding simultaneously many threads upon the spindles. Neither Hargreaves' Jenny nor Crompton's mule contained automatic mechanism for backing-off, winding-on, or shaping the cops, such mechanisms becoming really successful fifty years later in the self-acting mule of Richard Roberts although other inventors had been working in this direction in the meantime.

A Hargreaves' Jenny, an Arkwright's throstle spinner, and a portion of a Crompton's mule have for a long time been assembled in the Central Museum at Bolton and the present author has frequently taken students to examine the same. Crompton's name is more intimately connected with Bolton and the author has scores of times passed the house at Firwood Fold in which Crompton was born, and also the much larger Hall-ith-wood in which Crompton invented his mule, the two houses being separated only by a distance of possibly 400 yards, both at the Tonge end of Bolton. Hall-ith-wood has been purchased, renovated, and equipped as a public museum for Bolton, at the expense of Lord Leverhulme. Anyone may visit both Hall-ith-wood and also the more central Chadwick Museum, in which at present the old cotton machinery forms an important part of the equipment.

There are also several old spinning wheels and a roving-frame built in the early days of such frames.

Possible visitors to the two houses might take a Tonge Moor car and to Chadwick's Museum either walk it or take a Chorley New Road car, and ask for nearest stop in each case.

Roller Drawing.—It has been claimed that John Wyatt of Litchfield conceived the idea of roller drawing for wool about 1730 and had made a machine for the purpose by 1733. Lewis Paul was taken as a partner and himself obtained a patent for roller drawing in 1738, a very small factory being established but soon shutting up again. . . . "The original plan of Wyatt was to employ a pair of rollers for delivering, at any desired speed, a sliver of cotton to the bobbin and fly spindle, as in a flax-wheel.

Principles.—"The grand mechanical problem which the cotton

manufacture offered to the solution of the ingenious may be stated as follows: 'To construct a machine in which one member should supply continuously and uniformly porous threads of parallel filaments alongside of each other by an almost imperceptible gradation; a third member should at once twist and extend these attenuated threads unremittingly as they advance; and a fourth should wind them regularly upon bobbins exactly in proportion as they are spun.'"

This was the position —more or less well known—just prior to the period of the successful inventions of Hargreaves, Arkwright, and Crompton, and those more or less associated with them, and leading to the invention of the spinning machines of these three men between the short period of 1764 to 1789—or a matter of less than twenty years.

Whatever might have been done by Wyatt, Paul, Highs, Hargreaves, and other inventors, it appears clear that Richard Arkwright was the man who first made, or caused to be made, a machine which successfully, and on a commercial scale, drafted the cotton, twisted it, and disposed of it in suitable bobbin form.

Born at Preston in 1732, the youngest of thirteen children, he became in his manhood an apparently successful barber and hairdresser, having shops first in Preston and later in Bolton.

While serving his own trade he became fully conversant with the need for more successful methods of producing cotton yarns and in 1767 had a model made for him by Kay, a clockmaker, of Warrington, taking out a first patent in 1769 and a second and more complete one in 1775, and somewhat fully tested at Preston with the aid of Mr. John Smalley. Results were satisfactory but they were rendered very cautious by the riots at Blackburn which had attended the introduction of Hargreaves' Jenny. 1769 was not only the year of Arkwright's first patent but also of that of James, destined to do so much in driving the large cotton mills of later years, but Arkwright's first mill in Nottingham in 1768 to 1769 was driven by horses, Messrs. Need & Strutt, hosiery manufacturers, having become partners. In 1771 the three partners proceeded to the erection of the first water-spinning mill at Cromford on the Derwent in Derbyshire.

It may be here stated that Baines, Guest, and Montgomery were among excellent writers on the cotton industry shortly before Dr. Ures' excellent volumes were published, the book of Montgomery being of a practical and mechanical character, the other two more historical and generally descriptive.

Richard Arkwright was involved in many lawsuits in regard to his patents and businesses, but he must have been a keen commercial or business man. "Within eighteen years of constructing his first model, he had risen to such great estimation in the

county of Derby, that he was elected to the dignity of High Sheriff, and soon thereafter received the honour of knighthood from King George III., no indifferent judge of mechanical merit. He died in 1792 at the age of sixty."

Arkwright's water-frame was based on the Saxony wheel or continuous treadle and flyer spinner, and was in a sense the parent of the present flyer throstle and foundation of the ring-spinning and doubling-frames.

Hargreaves' Jenny and Crompton's mule were based on the ancient intermittent hand spinning wheel, and may be regarded as the parent of the modern mule-spinner and twiner-doubler.

For centuries there was rivalry between the hand-spinning wheel and the Saxony or treadle spinner. For 140 years there has been continued the rivalry between the continuous and intermittent spinning machines, and that rivalry is being continued at the present time, with the mule still ascendant in England, but the ring-frame ascendant in most other countries.

What will be the position 100 years from now?

Dr. Ure says, "In August, 1834, I was informed that Richard Arkwright, junior, was then spinning 'water-twist' yarns of as high counts as 80's of excellent quality at his mill at Bakewell and realising very large profits. The Strutts erected cotton mills at Belper and Milford.

"Arkwright was directly connected with carding engines, draw-frames and other machines for preparing the cotton for final spinning.

Crompton.—"When about 16 years of age, about 1769, Crompton learned to spin upon a Hargreaves' Jenny, and when about 21 years old began to do something towards a better machine.

"Finally he combined the method of drafting cotton by rollers, already successfully introduced by Arkwright, with the travelling carriage of Hargreaves' Jenny and so invented the spinning mule. There is no doubt that Crompton was a genuine inventor since he built himself an organ, and erected looms for the fancy weaving for which Bolton remains to this day a great centre. By 1829 it was estimated that about 7,000,000 spindles were working on the mule principle, but Crompton apparently received very little direct profit, although various subscriptions raised a fair total amount of money for him. In his later years Parliament voted him £5000. His sons appear to have been no better business men than their father, since they helped to loose the £5000 in a bleaching business and he died quite poor in 1827.

"Much about this time the operations of a cotton mill had become resolved practically into the divisions they have substantially maintained for a century: (*a*) cleaning and opening; (*b*) carding; (*c*) doubling and drawing; (*d*) roving and stretching; (*e*) actual

spinning; (*f*) winding, doubling, and singeing of the cotton yarns; (*g*) packing and bundling; (*h*) dressing machines; (*i*) power-looms and hand-looms.

"Crompton's mule and Hargreaves' Jenny apparently contained long cylinders or rollers for spindle driving, later succeeded by Baker's drums, which later on, were again superseded by tin rollers. There are yet many spinning mills at work in which the buildings are almost a century old, such as the old four factories at Bolton, Wood's long mill at Glossop, in which the author was once a foreman. Such buildings have been strengthened and modernised and renewed several times with the latest machinery.

"The *average price* per pound of cotton, from 1850 to 1859, inclusive, in the United States and Great Britain, respectively, is shown as follows:—

	In the United States.	In Great Britain.
1850	5½d.	7¼d.
1851	5½	6
1852	4	5½
1853	4½	6¼
1854	4¼	6¼
1855	4½	6
1856	4½	6½
1857	6¼	8
1858	5¾	7¼
1859	5¾	7

"There is a constantly increasing demand for cotton, not only for clothing, etc., arising from the growth of population and the diffusion of wealth, but also for admixture with wool, as well as in the manufacture of cordage, twine, and sail cloth, which are new branches of trade, to which cotton has recently been applied.

"The production of cotton ought to increase much greater than the population; for as civilisation and commerce extend, the number that will consume cotton fabrics, and the annual consumption of each person by reason of the greater productive power, will extend in a still greater ratio.

COTTON TRADE OF GREAT BRITAIN, SHOWING THE SOURCES OF SUPPLY IN DECENNIAL PERIODS.

	1806.	1816.	1826.	1836.	1846.	1856.
American	124,939	166,077	395,852	764,707	932,000	1,758,295
Brazil	51,034	123,450	55,590	148,715	84,000	122,411
Egyptian			47,261	34,953	59,600	111,960
E. Indies	7,787	37,670	64,699	219,193	49,500	463,932
W. Indies	77,978	42,235	18,188	33,506	9,000	11,320
Bales	261,738	369,432	581,590	1,201,074	1,134,100	2,467,918

"The cotton manufacture has been everywhere extending in the past quarter of a century, and consumption steadily gaining upon production. The weekly deliveries of cotton for consumption from the stocks warehoused in our ports have nearly doubled in the last ten years. In 1847 the consumption was but 20,259 bales per week; in 1859 it averaged 46,699 bales weekly.

"The consumption in the United States, in 1847, was 427,967 bales; in 1857 it was 702,138 bales.—Dr. Ure (Appendix, 1862).

Machinery Making.

The machine-making establishments have almost from the earliest days of the so-called Modern Cotton Factory System played a most important part in the development of the business, not only keeping pace with improvements, supplying machinery, and repair material promptly and at a reasonable cost, but sometimes also helping to finance new mills.

Some cotton machine-makers known to the present writer have either gone out of existence, or transferred their businesses, such as Roberts & Buckley of Stalybridge, Crighton's of Manchester, Sharp & Roberts, on whose make of mules the writer at one time worked, and Evan Leigh & Co.; or else their patterns and connections have become absorbed in other firms.

Hetherington's of Manchester long since took over the Curtis' firm and were identified with the introduction of the Heilmann cotton comber in 1851, just as more recently they have been the first makers of the successful Nasmith comber.

Most firms have specialised in spinning or in weaving, but some firms make machinery for both sides of the industry. Present well-known English makers include: Howard & Bullough, Tweedale & Smalley, Platt Bros., Dobson & Barlow, Hetherington's, Brooks & Dorey, Tatham's, Asa Lees, Taylor-Lang & Co., Lord Bros., Threlfall's, Hattersley's, Livesey's, Robert Hall, Hacking's, Arundel's, Stubbs', Holt's, Leeson Winding Co., and a host of makers of accessories and sundries for cotton mills.

There are long established textile machine shops on the Continent. Shlumberger's was referred to by Dr. Ure in 1836, and is yet in active existence although not a very large firm.

The Alsation Machine Co. is a very large concern, long famous for its products, and the transfer of Alsace from Germany to France due to the Great War, may have the effect of increasing French machinery competition as against English, since the above company will presumably be now freed from French tariff duties and can sell better to Lille, Roubaix, Turcoing, and Rouen.

There are Swiss firms such as Schweiter's, and Baer's, who make

lighter machines such as special winding frames and testing machines, whose machines are even to be found in England.

In America the Lowell Machine Co., the Howard & Bullough American Textile Co., the Whitin Machine Shop, the Draper Co. of Hopedale and a number of other firms, to a very large extent now monopolise cotton machinery-making for their own country besides reaching out to China.

The Northrop loom of the Draper Co., and the close winding-frames of the Universal Winding Co., are outstanding examples of the invasion of English and the world's markets by machinery of American invention and manufacture.

In England we may take the well-known firm of Dobson & Barlow as being typical of some others.

Isaac Dobson was born in 1767 about the time that Hargreaves invented the Jenny. As a young man Mr. Dobson came to Bolton, already well known as a centre of spinning and weaving, and not less so because of Arkwright's and Crompton's connection with the town.

It is stated that very soon after the invention of Crompton's mule, or in 1790, the firm of Dobson & Rothwell began to make spinning mules in Blackhorse Street, and this street is still an engineering centre but not for spinning machinery.

In 1791, Great Bolton was returned at 9,000 inhabitants and Little Bolton at 2,000 while the total is practically 190,000 in 1922.

Dobson & Rothwell's machinery was driven by horses at first.

There are definite records that in 1797 the firm built a mule of 130 spindles, $1\frac{3}{8}$ inch distance, for Robert Tickle, of Tottington, at a cost of £52 10s.

In the same year several others were made, as for example a mule of 232 spindles for Robert Lord, of Dofficocker, $1\frac{3}{16}$ inch distance, at a cost of £63. Among others, in 1799, a mule of 312 spindles, $1\frac{1}{4}$ inch distance, for James Fogg, of Astley Bridge, at a cost of £85 16s.

Yet another of 408 spindles, $1\frac{5}{16}$ inch distance, for Peter Haslam, of Edgeworth, at a cost of £112 4s.

Before 1820 Dobson & Rothwell had supplied complete equipments of carding engines with draw-boxes, drawing-frames, slubbing-frames, finishing fly-frames, roving billies and mules.

The name Benjamin Dobson superseded that of Peter Rothwell, deceased, in 1818.

The names of Isaac and Benjamin Dobson appeared among the list of first proprietors of the Bolton and Leigh Railway in 1825.

In the Chadwick Museum at Bolton there is now an old jack-frame made by Dobson's in 1830, and which worked for half a century in the Bolton mill of Ormerod & Hardcastle. It is an

example of bobbin driving and regulation of bobbin speed by means of uniform cones combined with an unequal let-off motion.

The present writer quite recently traversed the length of Blackhorse Street in which many of the first mules were made, and it is quite evident that it then became established, and has remained as an engineering and works centre, although Dobson's left it in good time.

At present the extensive steel works of Messrs. Henry Bessemer extend along one side of the dingy street for several hundred yards. On the other side of the street we find Hamer's second-hand textile machinery and engineering works, Kay's brass foundry, Rigby's calendar bowl works, Kershaw's roller leather works, and other establishments, intermingled with old houses.

The business of Dobson & Rothwell was transferred from Blackhorse Street to Kay Street in 1846. Part of the Kay Street works had been a chemical work appertaining to which was the highest chimney in England.

Within recent years the present writer has witnessed the shortening of this chimney partly owing excessive repair cost to the highest portion.

Built in 1842 for the chemical works the chimney, until the recent shortening, rose to a height of 367½ feet, with a diameter of 42½ feet at the base tapering to 24 feet at the top. The height was reduced in 1909 by 41 feet.

The present title of Dobson & Barlow was adopted about 1850. Some years later Mr. Rushton became a partner.

It is claimed for this firm that it is by far the oldest textile machinery establishment, and the firm held its centenary celebration in July, 1890, having then over 4,000 workpeople.

In recent years the firm have taken 40 acres of land at Bradley Fold, with half a mile of railway frontage, and already extensive works have been erected here, on the shed principle.

Crompton Memorials.

(1) *N.B.*—Thirty-five years after his death, a fine bronze statue of Samuel Crompton was erected in Nelson Square, near the middle of Bradshawgate. Public opening, 1862.

(2) There is an inscribed slab in the Bolton Parish churchyard, erected on Crompton's grave.

(3) Hall-ith-wood, where the mule was invented, presented to the town by Lord Leverhulme as a museum and containing one room devoted to Crompton relics, and containing a pipe organ built by Crompton among other items.

(4) Firwood Fold, where Crompton was born.

Old-Time Cotton Spinning Mills.

Some of the oldest concerns in the world for cotton spinning are seen every day by the present writer; 100 yards distant from Bolton Technical School is one built about 1792 by Messrs. Carlisle, abutting upon Bradshawgate—a main street of the town. Shortly after its building it became the property of W. & E. J. Bolling who were among the early cotton factory owners. For very many years one part of this old mill has been in the active occupation of a cotton waste dealer, and a still larger part as a corn mill, but the writer has recently noticed that the old title of "Bolling's" mill is yet retained on a sign at the inside mill end. The well-known Threlfall fine mules are built within 60 yards of Bolling's mill.

The celebrated "Old Fours" factories have been singularly furtunate in successive owners and managers, having apparently been continuously prosperous, and always appearing cheerfully working whenever passed in working hours by the present writer, although built in 1802, or 120 years ago. Always set out for fine spinning, adopting combers in good time, and keeping a good name, these factories in Turton Street may be regarded as an industrial marvel in cotton spinning, being in full operation many years before the death of Crompton.

The yet well-known firm of W. Gray & Sons, of Darcy Lever, is quite as remarkable in its continuous working to the present time, being still older, dating back to 1784, and there being a definite record of Dobson's supplying the firm with a mule of 228 spindles in 1798, containing both fine spinning and also combined with weaving; the author has often observed these mills, and has always regarded them with great interest.

Watt's Engines.

Watt's steam engine came into first use for cotton mills less than twenty years after Arkwright's first cotton mill was erected, and very shortly superseded the driving by horses and water-wheels, although water-wheels were retained in many cotton mills as a subsidiary power until well on in the nineteenth century. The present author was working at one of Wood's mills at Glossop in 1875, in which there was a very large water-wheel although the chief drive had always been steam engine and soon afterwards the water-wheel was removed.

As early as 1792 Watt's steam engines were working in mills at Bolton and Manchester, but some cotton mills in Lancashire and adjoining counties depended upon water-wheels for half a century.

Now, in 1922, electricity has displaced steam for main driving, in quite a number of cotton mills.

It has always been a fine thing for steam in cotton spinning

mills, that it is very suitable for the considerable amount of heating required.

Bolling's cotton mill, referred to previously, was one of the very early examples of placing a cotton mill away from river or canal. A lodge was built much after the present-day style, and one of the early beam engines was used to pump water upon the water-wheel which really turned the mill machinery.

Events in chronological order from Mr. B. P. Dobson's treatise on the "Evolution of the Spinning Machine."

A.D.	
" 1533	Brunswick spinning wheel invented.
1629	Giovanni Brancas invents a steam turbine.
1660	Marquis of Worcester uses a steam pumping engine.
1705	Thomas Newcomen invents atmospheric steam engine.
1732	Sir Richard Arkwright born.
1738	Lewis Paul patents a machine for spinning with rollers.
1738	John Kay patents the fly shuttle.
1748	Lewis Paul patents a carding engine.
1748	Daniel Bourne patents a roller carding engine.
1752	Highs and Kay experiment with rollers for spinning.
1753	Samuel Crompton born at Firwood Fold.
1767	James Hargreaves invents the spinning Jenny.
1767	Isaac Dobson, founder of the oldest textile machine works, born.
1769	Richard Arkwright patents the water frame.
1770	James Watt invents pressure steam engine.
1770	James Hargreaves obtains patent for the spinning Jenny.
1771	Richard Arkwright builds Cromford Mills, Derbyshire.
1772	Coniah Wood invents moveable winding rail.
1772	John Lees improves the feeding of carding engines.
1774	Samuel Crompton begins to construct the mule.
1775	Richard Arkwright invents automatic winding rail.
1779	Samuel Crompton completes the mule.
1779	Machine breaking riots.
1780	Marriage of Samuel Crompton.
1780	Richard Arkwright invents the draw-frame.
1780	First cotton factory built in Bolton.
1781	Action for patent infringement, Arkwright *v.* Mordaunt.
1790	Isaac Dobson founds textile machine works.
1792	Death of Sir Richard Arkwright.
1792	William Kelly patents power mule.
1792	First steam engine used in Bolton (for pumping water).
1794	Saw gin invented by Eli Whitney in America.
1797	Scutcher invented by Snodgrass of Glasgow.

1798 Fourteen mules made by Messrs. Dobson & Rothwell.
1800 Benjamin Dobson joins his uncle in Bolton.
1800 Manchester subscription for Samuel Crompton.
1802 Sir Robert Peel's first Factory Act.
1802 The "four factories" built.
1812 Parliament vote £5,000 to Samuel Crompton.
1818 Death of Mr. Peter Rothwell, of Messrs. Dobson & Rothwell.
1818 Benjamin Dobson taken into partnership.
1818 The "Royal Sovereign" mill destroyed by fire.
1819 Death of James Watt, the famous engineer and inventor.
1819 Second Factory Act passed.
1823 Archibald Buchanan experiments with card flat stripping mechanism.
1824 Annuity purchased for Samuel Crompton.
1824 Roberts patents self-acting mule.
1825 Bill for the Bolton and Leigh Railway passed.
1827 Death of Samuel Crompton.
1829 Old Hill Mill destroyed by fire.
1831 Truck Act passed.
1833 Death of Mr. Isaac Dobson at Gilnow House, Bolton.
1835 Smith experiments with revolving flat card.
1835 Wm. Bolling, cotton spinner, elected M.P. for Bolton.
1850 Evan Leigh patents revolving flat card.
1853 George Wellman invents the Wellman card."

Treatises on the Cotton Industry.

The cotton industry has been well catered for in regard to literature almost from the beginning of its importance and there are now many publications available, both new and old.

Names of authors that may be mentioned are as follows :—

Guest, Baines, Montgomery, Ure, Scott, Andrew Gray, French's "Life of Samuel Crompton," "Account of Lewis Paul," by Robert Cole, Evan Leigh's 2 vols., "Cotton Gins," by Dr. Forbes Watson, Richard Marsden's "Spinning and Weaving," several modern works by Wm. Scott Taggart, Nasmith's "Student's Cotton Spinning," Chapman's "Economics," several works by the author of the present treatise, Fox's "Mechanism of the Loom," Nisbet's "Preliminary Processes of Weaving," Watson's "Design," Winterbottom's, and Thornley's "Calculations," Holmes' "Weaving Calculations," Brown's "Power Loom," also quite a number of other British books, as well as many written in America or on the Continent of Europe. Most cotton machinery firms issue catalogues which may well rank as up-to-date text-books. The current press

attends strongly to the cotton trade, both in regard to daily, weekly, and monthly publications.

We may add "Cotton Carding" and "Some Difficulties in Cotton Spinning," by Benjamin Dobson, as well as "Cotton Gins," by his son B. A. Dobson.

Various textile societies have issued reports of lectures; such as the Textile Society of Manchester College, and several Managers' Associations.

Messrs. Platt Bros. state: "Total value of cotton yarn produced in Great Britain was £200,000 in 1760. In 1894 it was £90,000,000, although in 1894 costing could be taken at a little more than one-third the cost of production in 1760, as will be seen from the figures below:—

GREAT BRITAIN.

Year.	Spindles in Operation.	Operatives up to and including Spinning, not including Twining, Doubling, Reeling, Winding, etc.	Operatives per 1,000 Spindles, not including Doubling.	Hours per Week.	Average Wages per Week.	Production per Spindle per Year.	Yarn Spun.
					s. d.	lb.	lb.
1830	10,000,000	90,000	9	69	11 6	21·6	216,500,000
1860	30,000,000	120,000	4	60	14 0	30·3	910,000,000
1894	45,000,000	135,000	3	56½	19 0	32·5	1,465,000,000
1901	48,000,000	140,000	2·9	56½	20 0	33·3	1,600,000,000
1906	53,000,000	220,000[1]	2·9	55½	21 0	39·6	2,100,000,000
1920	60,000,000	250,000	3	48	65 0	35	2,000,000,000 (Approx.)

"The production per spindle of 32's twist has increased as follows:—

1866,	22½	hanks, Mule,	in a week of 60	hours.
1885,	28	,, Mule,	,, 56½	,,
1893,	31	,, Mule,	,, 56½	,,
1893,	44	,, Ring,	,, 56½	,,
1915,	31	,, Mule,	,, 55½	,,
1915,	44	,, Ring,	,, 55½	,,
1920,	27	,, Mule,	,, 48	,,
1920,	40	,, Ring,	,, 48	,,

"In 1760 the weight of cotton imported was about 3,870,000 lb.,

[1] The figures in this instance include Doubling as well.

the value of 1 lb. of No. 42's counts of yarn being 10s. 11d., and of 100's counts 38s.

"In 1913 the weight of cotton imported was 2,174,299,600 lb., and the value of the cotton yarn produced in Great Britain was approximately £110,000,000.

"The value of 1 lb. of No. 42's counts of yarn was 11d., and of 100's counts 2s. 1d., whilst the total number of spinning spindles was about 57,000,000."

VISIBLE SUPPLY OF COTTON.

(18TH AUGUST, 1922.)

	American.	Egyptian.	East Indian.	Others.	Total.
Stock—	Bales.	Bales.	Bales.	Bales.	Bales.
Liverpool . . .	397,720	86,680	18,990	229,440	732,830
Manchester . . .	40,730	12,510	2,700	530	56,470
London . . .	—	—	700	840	1,540
Afloat—					
Great Britain . .	32,000	13,000	12,000	41,000	98,000
Total for Great Britain	470,450	112,190	34,390	271,810	888,840
Stock—					
Continent . . .	379,230	10,990	22,100	18,700	431,020
Afloat—					
Continent . . .	99,000	9,000	78,000	6,000	192,000
Total for Continent .	478,230	19,990	100,100	24,700	623,020
Stock—					
U.S., etc. . . .	702,000	203,000	9,000	—	914,000
Grand Total . .	1,650,680	335,180	143,490	296,510	2,435,860

American this week 85,370 decrease, total 84,060 decrease, against American same week last year 93,140 decrease, total 92,660 decrease.

WORLD'S SPINNERS' TAKINGS OF AMERICAN COTTON.

	In 1000's of Bales.					
	This week.			Since 1st August.		
	1922.	1921.	1913.	1922.	1921.	1913.
Great Britain	37	37	44	118	112	154
America	76	70	66	307	220	116
Continent	66	96	58	151	149	207
Japan and Mexico . . .	14	32	—	26	99	2
Total	193	235	168	602	580	479

SPECIAL REPORT OF WEATHER IN THE COTTON BELT.

Observations taken to 8 a.m. (American Time), 18th August, 1922.

Station.	Temp. (24 hours). To-day. Max.	Min.	Rainfall (24 hours) To-day Inches.	Weather To-day.
Raleigh, N.C.	86	68	—	Clear
Charleston, S.C.	80	74	$\frac{6}{10}$	Cloudy
Augusta, Ga.	—	70	$1\frac{6}{10}$	Clear
Atlanta, Ga.	84	68	—	Clear
Montgomery, Al.	86	70	—	Cloudy
Meridian Mis.	—	72	—	Clear
Vicksburg Mis.	90	74	—	Clear
Shreveport, La.	92	72	—	Clear
Memphis, Ten.	90	76	—	Clear
Little Rock, Ark.	92	72	—	Clear
Fort Smith, Ark.	96	74	—	Clear
Oklahoma	98	74	$\frac{2}{10}$	Clear
Amarillo, Tex.	90	70	—	Clear
Fort Worth, Tex.	—	80	—	—
Abilene, Tex.	96	72	—	Clear
Taylor, Tex.	—	76	—	Clear
San Antonio, Tex.	98	76	—	Clear
Galveston, Tex.	92	78	—	Clear
North Platte, Neb.	98	—	—	—

EGYPTIAN COTTON.

Alexandria "Futures."

	Ashmouni		Sakellaridis.	
	Aug.	Oct.	Nov.	Jan.
Thursday's close	24·85	25·80	34·20	35·10
Friday's opening	—	27·00	35·75	—
,, close	25·30	26·40	35·40	36·30

Friday's receipts 149 bales, against 200 last year.

Welfare Work.

Welfare work was developed very considerably in munition works during the war, and the boom years immediately succeeding the war witnessed the rapid extension of welfare in English cotton mills. Temporary difficulty in obtaining competent operatives, desire to obtain maximum productions and retain good workers, along with the great profits then being made, all had an influence in bringing welfare work into prominence, and it has become established in one degree or another in very many cotton mills, but is practically ignored in many others.

Welfare work in cotton mills varies in degree, all the way from just simply providing hot water for tea or at most a cup of tea, in the middle of the forenoon or afternoon, right up to elaborate arrangements in which free schooling with wages is provided for young folks for one or two half-days of the working time, along with gymnasium exercise, tea during working hours, and all kinds of facilities for outdoor sports and indoor recreation during the home hours.

Certain of the largest and most important cotton firms have taken a strong lead in welfare work and have set a great example to others in the trade.

Some of these firms and their work are so well known that we may venture to mention some of them by name.

We may, for example, refer to Messrs. The Howe Bridge Spinning Co., Messrs. Ashton Bros. of Hyde, Messrs. Tootal, Broadhurst, Lee & Co. of Bolton and Manchester, Messrs. Burgess, Ledward & Co. of Walkden, Messrs. The Belgrave Spinning Co.

The Author has paid personal visits to such firms as Ashton Bros., Howe Bridge Spinning Co., and Tootal, Broadhurst, Lee & Co., and had much of the work explained.

Take the case of Ashton Bros. as a strong example. One section of the work has been the provision of evening lectures, and the Author had the privilege of delivering two such lectures during the winter session of 1920-21. A magnificent gymnasium was shown to him, and a very commodious dining-room, in which the operatives regularly provided excellent singing and music for themselves during some portion of the meal hours, especially going strong at times at the dinner hour concert. This firm provided tea on hot afternoons for many years before the war, an old man taking the tea to the workrooms and the operatives bringing pots and cans to him for a supply of tea. More recently the tea distribution has been more perfectly organised, small trucks being run from the dining-room to several departments, this occurring twice a day. Sections of the welfare work at this important firm may include:—

A trained nurse who attends at the mill and visits sick workers, rest-rooms (perhaps more especially useful for women suffering from very temporary faintness or illness during working hours), nourishment scheme, cloak-rooms, advisory committees for spinning and weaving departments, scholarship scheme, gymnasium for boys and girls, football teams, hockey teams, swimming clubs, cricket club, cycle club, bath-room, dance and social committee. The foregoing is given as one of the most complete examples of welfare work, and indicates the lines on which large firms especially may move along.

At one important firm the writer was taken to the ordinary dinner provided for the operatives, and it was astonishing what an excellent two or three course meal was provided at a low cost, with not much monetary loss to the firm and a direct gain in other ways.

At the great firm of Messrs. Tootal, Broadhurst, Lee & Co. there has long been a fine school in the grounds and this has led to the day-time educational scheme for boys and girls during working half-days becoming perhaps more developed than in any other cotton mill welfare scheme. Indeed in this case the scheme was personally examined by Mr. Fisher, Minister for Education, and greatly commended by him. The present Author had the privilege of accompanying a party through this school and its connection under the personal guidance of Mr. Harold Lee.

Medical and dental attendance, gymnasium work, and various health and recreation facilities have obviously done much good to the young people of this firm. Greater difficulty is experienced with small firms and less prosperous ones, in successfully promoting extensive welfare schemes, than is the case with large and prosperous concerns.

In some cases welfare work has been almost confined to providing tea in the middle of morning and afternoon, and the provision of a rest-room in charge of a competent and sensible matron. In one such Bolton case of a weaving firm employing about 600 operatives cases for one week were quoted as follows: Headaches and faintings 14; re-dressings 3; slight accidents 4; septic wounds 2; sprains, etc., 10.

In some cases the work of the welfare superintendent or director has been blended with the duties of engaging and discharging the operatives, but this is obviously a matter to be handled delicately, if trouble is be avoided with the foremen and managers.

Fatigue and Efficiency in Cotton Mills.

Investigations were made in 1919 in regard to causes of fatigue among the operatives in cotton mills. The investigating board contained representatives of masters, workers, and factory inspectors.

In some weaving mills it was found there was a difference in wage-earning of 29, 30, and 72 per cent. respectively in the same mills. The human factor probably plays a greater part in weaving —especially in fancy goods—than in the more automatic processes of a spinning mill.

It does not appear that any concerted action can be taken in the way of reducing the amount of fatigue. Good cotton, good yarn, moderate machine speeds, good stores, machines in good order, a supply of tea in forenoon and afternoon, suitable conditions of heat and humidity, well lighted and ventilated rooms, well-trained and careful operatives, confidence in the management; these are the factors needed to reduce fatigue and keep machines going.

Factory Acts protect the workers in matters relating to dust removal, ventilation, hours of labour, fencing of machinery, age for commencing work, unemployment, and insurance. Many employers now go much further than this in voluntary welfare work, which has already proved abundantly successful, but chiefly so in large works which engage very many operatives, and especially if the concerns are reasonably prosperous.

Welfare schemes were established by many important private firms forty or fifty years ago, but long continued bad trade, death of leading individuals, changes in ownership and allied causes, sooner or later told badly against such schemes.

In many present examples of small mills, it sounds a little funny to talk about swimming baths, concert rooms, canteens, gymnasiums, mill schools, sports clubs, welfare matrons, but perhaps something can be done in organising a few mills together for welfare work.

Operatives of the present day are certainly better educated, and are perhaps more sensitive and responsive to welfare than they were forty or fifty years ago.

Welfare schemes are often best when largely controlled by the workers themselves by committees on which the employers have proper representation.

Welfare schemes should be initiated unselfishly and with little if any appearance of philanthropy on the part of the employers. Welfare matrons appear to advantage in large establishments employing large numbers of females, and it has been stated that the textile trades of England employ possibly two-fifths of all the women in industry, while in the combined spinning and weaving mills there are many more female operatives than male.

CHAPTER XI.

MISCELLANEOUS.

Woven Belting.

There have been great achievements in making solid woven belting for driving, conveying and other purposes.

Any limits required in extremely narrow, or extremely wide woven belts from 2 inches upwards, any degree of thinness or of thickness may be obtained in woven belting, and in almost any length required.

Woven belting may be made from cotton preparation yarns of 6's to 10's counts, or in the better qualities from doubled Egyptian cotton yarn, hemp, ramie, wool and other yarns.

Raw Cotton Supply.

On 13th January, 1923, Mr. Sewell lectured at Bolton on the question of the cotton fibre, its quality, characteristics, and future prospects.

It was pointed out that Sakellarides cotton had been going for about eleven years and was now becoming shorter in staple.

About ten years ago it only represented about 10 per cent. of the total Egyptian cotton crop, but last season it reached more like 75 per cent.

From micro-photos prepared by himself it would appear that Indian cotton fibres were practically twice the diameter of Sea Islands. A few years ago he counted the twists per inch on good Sakellarides to equal over 340 per inch, but in the latest crops he only estimated the twists in good ripe fibres to be about 270.

The Egyptian soil was possibly not as good as formerly owing partly to growing cotton on the same land every other year instead of every third year as formerly—a practice which was to be revived. Also the barrage system prevented the "silt" from reaching and improving the soil as much as formerly. While a small rainfall might occur at Alexandria, and a still less amount at Cairo, there was practically none on the Egyptian cotton fields, but there was

some talk of using a little fertiliser material in future—a rather exceptional thing on these cotton fields.

Mr. Sewell showed illustrations of damage to cotton pods by boll-worms and boll-weevils. Egyptian cotton was lower in quantity owing to political troubles, insect damage, poorer soil.

Referring to American cotton maps were shown conveying an idea of the travel and ravages of the boll-weevil for many years past. The damage done by this pest during the last quarter century was exceedingly great and was quickly and greatly extending in spite of efforts to check it.

The boll-weevil of $\frac{1}{4}$ inch long attacked the boll, made an aperture therein then laid possibly five eggs in the hole, which very quickly hatched and increased the evil. It has been estimated that the boll-weevil has extended its destructive operations over more than 20,000 square miles of added area in the last year, and that the crop of America will become annually less by about 4,000,000 of bales of 500 lb. each by reason of this pest, unless better means of checking it can be found.

American mills now take a much larger proportion of their own cotton crop.

In 1921 they took more than half of their total crop of about 8,500,000 bales, but pre-war the American cotton crop totalled more like 14,000,000 of bales.

The Southern States have increased their spindles from about 4,250,000 to more like 16,000,000 in about twenty years' time, and since these mills mostly spin rather coarse counts, they require a very large weight of cotton.

Australia may in future help somewhat in solving the problem of raw cotton supply.

It has been estimated that in 1923-24 there ought to be a quarter of a million of bales from Australia.

Brazil is regarded with a still more favourable eye in regard to possible future supplies of raw cotton and ought to give 1,000,000 bales per annum of 500 lb. each, if there were provided adequate irrigation and transport, along with the required care, skill, and labour in cultivation.

It has been contended that Brazil soil can give as much as 500 lb. or more, of lint per acre, as against less than 300 lb. in America, Egypt 400 lb., and India 100 lb.

An excellent feature of most American cotton is its white colour not easily equalled elsewhere, although more white cotton is now coming from Nigeria although not as good. Many years ago the present author examined Queensland cotton and found it quite inferior to Texas, but latest tests place some Australian cotton at $1\frac{1}{8}$ inch staple and quite as good as Texas.

Cotton Research.

Research in the cotton trade has been much to the front for some years past, culminating chiefly in the setting up of the Shirley Institute, with suitable and attractive buildings, complete and up-to-date equipment, and a staff of scientific experts, along with other requisite assistance. The Textile Machinery Exhibition at the Manchester City Hall in October of 1922 focussed attention on a good many recent developments in textile machinery and accessories. Such an exhibition brings new ideas before the trade in a much quicker, more direct, and perhaps more appealing manner than do the ordinary means of intercourse. In this connection, also, it may be said that well-equipped textile schools now play no mean part on more or less similar or allied lines.

As regards the standard and fundamental machines in cotton spinning and weaving it is an exceedingly difficult matter to alter these very materially. Given, for instance, revolving flat carding engines, fly-frames or mules installed over twenty years ago, and kept in good condition with possibly the addition of small improvements by the aid of the depreciation fund; it has been repeatedly brought before the author's notice that absolutely new machines may scarcely do any better than the foregoing in the mill. The training of mill foremen in up-to-date appliances and developments should lead them to view more favourably the introduction of new devices and possibly to give the same a better trial. Doubtless harm has been done by some new ideas being introduced with too great a flourish of trumpets and yet failing under a proper mill trial.

It is the present writer's considered opinion that more could be done in advancing new ideas by better collaboration between machine shops, technical schools, manager's associations, and cotton mills.

Research Report.

"*Yarns.*—The British Cotton Industry Research Association has recently completed a research resulting in the production of an instrument for recording the regularity of yarns. By its means the regularity of the hardness of yarns up to 200's count may be tested. The yarn is drawn between a pair of case-hardened shoes which smooth out stray fibres, and it is the apparent diameter under these conditions which is measured.

"The diameter is dependent on (*a*) the hardness of twist, and (*b*) the fibre concentration and fibre regularity; variations which are dependent on the method of spinning. This method of determining the diameter of yarn and its variations cannot but have a profound effect in affecting the finished product after its application has been more fully determined."

Cotton "Futures."—12th September, 1922.

The New York and New Orleans Cotton Exchanges are stated to have been organised about 1870 in order to establish uniform conditions, rules and contracts, to govern the buying, selling, and shipping of cotton.

In a few years it became very evident that certain features affecting cotton were difficult to regulate by any rules or regulations; such as the amount of world's cotton grown in any one year, and the amount of cotton consumed by the world in any one year.

Such conditions as these provide openings for hazards, guesses, and speculation.

To reduce trade risks and speculation to a minimum, trading in cotton for future delivery was instituted by the Exchanges.

"Futures" contracts, of course, should be fair to all concerned, whether it be the cotton planter, the cotton importer, the cotton spinner, the cloth manufacturer, or other person directly affected.

They should include the whole of the cotton grown, contemplate the delivery of actual cotton, and secure to the purchaser the right to demand the cotton if he desires.

Very frequently, "futures" contracts are settled by means of legal offsets or rings before becoming fully matured and without actual delivery of cotton. In such a way they serve the important purpose of interim hedges or contracts to protect banks, merchants, mills, and cotton growers, against decline or advance of cotton prices from marketing the cotton to its sale after converting into yarn or cloth.

It is thus possible to trade forward without buying the cotton sold for future delivery at the time of the forward trade. When actual cotton is required the transaction may be transferred from "futures" to "spot" cotton.

The cotton planter may hedge his crop by means of "futures" transactions, months before his cotton is ginned, baled, and sent away.

Assume that the farmer in July believes that the then price for November cotton is probably higher than he will get in November, he may, if he likes, sell November "futures" against his probable crop, and thus get a better price than he would if the price declines by November.

American cotton is marketed in bulk during the months of September, October, November, December, and January, the merchants obtaining stocks of cotton as the planters sell their cotton.

The "futures" market enables the merchant to accumulate stock without usually taking very serious risks, since he may buy cotton for actual delivery, hedge by means of selling "futures" contracts,

and as the season progresses, gradually sell his "spot" cotton, and buy in his "futures."

Weekly settlements facilitate such business by preventing speculators from getting very far wrong. Forward sales are very serviceable in the cotton trade, especially as time taken in packing and transportation may extend for some months.

Protection may be afforded by "futures" against either decline or increase in price.

"Hedging" is well recognised as offering solid protection against violent fluctuations in prices and is insisted upon by steady concerns and many reliable banks.

The safety provided by "futures" contracts enables banks to loan considerable sums of money upon reasonable interest to merchants, planters, importers, spinning firms, or weaving firms. The cotton spinner utilises the "futures" market by purchasing "futures" against his forward sales of yarn; or he may protect himself against loss upon unsold stocks of yarn.

One authority states as follows:—

"The 'future' hedge is not a perfect one, but it is the most economical one, and best price insurance which men of every nationality engaged in the cotton business have been able to devise to ensure an initial profit or minimise a possible loss. . . ."

"'Future' trading has opened the cotton market to the world, and has been useful in stabilising prices; in furnishing correct quotations of the market value of cotton; in eliminating the risk of violently fluctuating markets; in reducing the cost of marketing; in furnishing a ready market for cotton at its market value, and in maintaining a reasonable parity between 'future' and 'spot' prices, thereby posting the producer, the merchant, the banker, and the consumer as to the price of cotton daily. It has furnished a market for any part of the year."

Defective Bales.

Two kinds of defective bales are as follow:—

1. All bales below purchasing sample on reaching mill.

Both buying broker and selling merchant are to blame in such a case.

The spinner's broker is supposed to examine and pass every bale and not to let bales pass that are below sample.

The selling broker or merchant is supposed to deliver up to the sample, such bales may be returned.

2. A bale may be defective by false packing which may deceive both brokers and mill manager until opened. A great or less amount of dirty, poor material may have been placed in the middle of the bale inside the correct cotton.

"False packs" may be traced back to baling press or ginnery, and should be weighed off and claimed for.

The Tele-writer or "tape" is of great assistance in quickly recording price variations, in the great cotton centres of New York, New Orleans, and Liverpool; also reaching to Manchester Exchange.

Cotton Growing Developments.

It would appear that the destructive propensities of the boll-weevil have spread so much over the cotton growing area of the southern states of the American Union that the production of cotton per acre has seriously diminished. The cotton trade of recent years has had to widen its outlook in regard to raw cotton supplies, and has surveyed more and more the possibilities of other parts of the world.

Developments and experiments in regard to raw cotton have also spread in the United States of America, with the result that a long-stapled cotton is now grown in Arizona and California which possesses many of the valuable features of the best Egyptian cottons.

Quite recently important investigations have been made in Brazil for the purpose of opening up much better lines of communication and facilities for the transport of raw cotton, and this cotton is mostly of quality ranking generally next to Egyptian. Efforts have been made also to better educate the Brazilian cotton growers in regard to selection of the best seeds and maintaining pure strains.

Peru also offers excellent chances of growing an increased quantity of good staple cotton, and communication lines may be improved in Peru to advantage.

The West Indies have always attracted attention from the point of view growing more cotton of good quality, and much has been done in these Islands since about 1908.

West Africa, East Africa, Uganda, Tanganyika, have been centres of many cotton growing experiments of recent years and much cotton is now obtained from such places.

India has long ranked as the second most productive centre in the world for raw cotton, but efforts for some time have been devoted towards obtaining Indian cotton of longer staple and of greater yield per acre.

Mesopotamia has been subjected also to cotton growing efforts, although there are great limitations in regard to both people and country. At the moment of writing cotton growing is receiving great attention in Queensland and other parts of the Australian Dominions.

As far back as 1900 the present writer had samples of Queens-

land cotton sent him for examination, this cotton much resembling ordinary American cotton, but allowed to grow several years in succession on the same plants. In Australia there is abundant land with suitable soil and in a good climate, but there is greater need of the proper kind of labour. Transit of raw cotton from Australia to England would be somewhat costly. Immense engineering schemes are proceeding in the Soudan, including barrage works for holding up the waters of the Baraka and the Gash.

Australian Cotton, October, 1922.

"When cotton growing has been further developed in Australia it must serve as an attractive inducement to emigration, inasmuch as it provides a quick return from the soil for the settler, and a certainty for a livelihood during the first few years of his tenure on the land, while other crops such as fruit are maturing.

"The whole project of cotton growing in Australia has been referred to in the United States as a statesmanlike effort on the part of Australia, an effort which may prove a useful contribution towards solving many problems of the day, such as possible shortage of cotton in the future, unemployment in England, and that most difficult problem—the Pacific question.

"There should be ultimate success of this venture in Australia, unless an antidote to the boll-weevil is found in America, when the success may be less marked.

"Needless to say, the most stringent precautions are being adopted to prevent the pest's introduction into the Australian cotton areas."

"The New South Wales Government has enthusiastically taken up the question of cotton growing. Recognising the immense scope there is for the development of this industry on commercial lines, it has decided (says a Reuter's Sydney message) to encourage production of this crop in every possible way.

"The Government has secured a large supply of seed which it is distributing free to farmers to enable experiments to be made in various parts of the State. By this means suitability of soils and productive and commercial possibilities will be readily ascertained at a minimum of risk and cost to growers.

"Last year small experimental plots were planted in a number of districts, and as a result of the success achieved extensive areas in those parts are to be planted in the coming season."

On 29th November, 1922, the present author was asked to express an opinion upon a submitted sample of New Australian cotton. This cotton was of very good white colour, with bulk of fibres equal in length to good American cotton, but containing a somewhat

large proportion of short fibre. It felt very smooth and soft, but was not strong.

More suitable for weft yarns than twist.

Egyptian Cotton Crop, October, 1922.

The second report of the Cotton Research Board states that the Board consider that the figures given justify the conclusion that by careful cultivation and selection of seed the Egyptian crop could be substantially increased in quantity and considerably improved in quality.

After consideration of all the facts the report enunciates the general conclusion that two factors alone are sufficient to account for the diminution in the Egyptian cotton yield recorded since 1913, without considering 1921, which was an exceptional year.

First, the old brown cottons were almost entirely replaced in Lower Egypt by Sakel, which gives a smaller crop but a higher return owing to its superior quality. The area under Sakel increased from 7 per cent. of the total cotton area in 1911 to 73 per cent. in 1919, and this change was responsible for reducing the average yield in the whole country by about 12 per cent.

The second factor is the increased damage due to insects since the appearance of the pink boll-worm.

The Board concludes that there is hope that the rapid decline in yield has now reached a maximum, and it should be possible to maintain the yield so long as the same variety is grown in a reasonable state of purity and sound methods of cultivation are practised.

Reports from spinners regarding the new variety of cotton named "Balls 510" are most encouraging, and the area of land devoted thereto will be quadrupled during the coming season.

Egyptian Cotton Lands.

The ancient Egyptians worshipped the Nile as the source of Egypt's prosperity, and a leading statesman has declared that the Nile is Egypt and Egypt is the Nile.

For centuries this age-long theory of the value of the Nile silt has been upheld. Science, however, now shows that they were rather too enthusiastic in their praise. The Nile certainly plays its part, but it is not the whole show.

According to the Egyptian Cotton Research Board, investigations which have been carried out by the chemists show that sufficient importance has not been attached to the action of the sun as a sterilising agent, rendering the soil fit for rapid nitrification.

"The suggestion is undoubtedly interesting. It is intended to

suggest that the researches referred to show that too much stress has been laid by the cotton experts on the fertilising value of the Nile water table; that is to say, the rise to the actual level of the water in the neighbourhood of the Nile due to its rise when it is in flood.

"The water percolates through underneath the surface and rises to a certain extent on each side of the bank. If the high water table level is too high it rots the roots of the plants, and if it is too low it may cause the roots to atrophy on account of excessive draught, the idea of the irrigation work being to maintain this water table at the best level for the proper development of the plant.

"The report means that the value of that action has been perhaps a little exaggerated."

Growing Competition Facing Lancashire.

"The enterprise and energy of Indian textile manufacturers is to be admired, but their competition with Lancashire industry cannot be ignored," said Dr. J. F. Crowley, Consulting Engineer, of Westminster, in an address to the Textile Institute in October, 1922.

Dr. Crowley said India had factories of which Lancashire would be proud. Their driving arrangements in many cases were in advance of those of Lancashire or Dundee. The splendid factories Scottish pioneers had erected on the banks of the Hooghly at Calcutta had given accommodation for 40,000 looms and 800,000 spindles, and altogether over 270,000 persons had been provided with employment.

Electricity was in general use, power being provided from central stations, which were often put up by associated groups of manufacturers. Similar conditions applied in Bombay. Manufacturers in India were preparing to invade territory which Lancashire and Dundee formerly regarded as their own. Fine cotton yarns and jute fabrics hitherto not made outside Britain would soon be produced in increasing quantities by Indian manufacturers. Where Indian conditions were considered unfavourable Indian manufacturers were arranging to manufacture outside India, but with Indian capital and under Indian control.

The home manufacturer should do everything possible to improve the manufacturing processes, particularly from the point of view of increased productivity. The attention of both labour and finance must be constantly devoted to the problem of increasing output from each individual factory.

Peruvian Cotton (1922 Report).

It has been said "Peru is an ideal cotton country, of which even prehistoric Peru was aware. In the tombs remaining from that remote period cotton fabrics have been found. Under the Incas the whole population not only manufactured its own cotton textiles, but exported the raw cotton to the most distant parts of the empire, while in the colonial epoch the Spanish Government erected large spinneries, and permitted the natives to develop the industry.

"The wonderful climate of the well watered coast valleys where the difference between the night and the day temperature produces the gentlest and kindest conditions for the growing cotton, aided by the salt sea spray from the Pacific, which deposits its sodium chloride upon the plant—contribute to the creation of that 'full rough,' so greatly esteemed by woollen manufacturers.

"Peruvian cotton (Gossypium Peruvianum) is grown in the valley of Piura, and is indigenous to Peru. It is a tree-like plant, has a life of six years, and requires little watering. The best kinds are produced in Catacaos, Sechura and La Chira—lands formed by the river deposits. Gossypium Herbaceum, known as 'Upland' in the United States, and as 'Egyptian' in Peru, is grown in the valleys of Lambayeque, Rimac, Chancay, Lurin, Cañete, Chincha, and other parts. With frequent watering this sort gives better results than the above. 'Sea Island' and 'Mitafifi'—varieties of the Gossypium Barbadense—are grown in the valleys of Pativilca and La Chira, Supe and Huacho, although not very extensively. The kind known as 'Chanchamayo,' from which excellent results have been obtained, is a spontaneous growth of the wonderful Montana region—a region promising boundless possibilities of development in the future. There is still another kind of cotton which has attracted British spinners. This cotton is the result of the researches of Mr. Tanguis, and is becoming more and more esteemed. Tanguis cotton has made a name for itself in Lancashire.

"After the first year the crops increase year after year, until the sixth year, when the plant fails. This is the famous 'full rough' so well known, the roughness becoming the greater the nearer the plant is to the sea. This 'full rough' is exclusively grown in those plantations near the sea, for all attempts to secure a similar grade in other parts of the country have failed.

"Greatly condensed Egyptian seed cotton is grown in coastal valleys and grows in the form of a shrub, one to one and a half metres high. It is a plant with two years of life, being very much reduced and inferior quality in the third year.

"Not only is it not necessary to renew the plantation in Peru,

as is the case in America, where the plant yields but one crop, but the cotton lands are not scourged by the boll-weevil.

"There are vast areas in Peru awaiting the enterprising cotton grower.

"It has been stated that the yield per acre in Peru is much greater than in other countries. In the United States this may be taken—in the better years—as 309 lb. per acre. In one case the Agricultural Bureau estimated the yield per acre at 157·21 lb. In Egypt the acre yields 390 lb. and in India 370 lb. But Peru's average yield is 484 lb. per acre, which, however, varies according to the district.

"There are the allied industries dependant upon cotton. The production of cottonseed oil in Peru in 1919 was 1,706,000 kilos, valued at £P13,334; of oilseeds, 32,228,000 kilos valued at £P257,831; and of oil cake, 11,510,000 kilos, valued at £P77,697. There are several mills in Peru for the production of oil, cake, and soap, and these industries are steadily developing, as their increased output year by year shows."

In July, 1922, a Peruvian commercial gentleman was taken by the author through the Bolton Textile School and made strong statements regarding the opportunities for the cotton trade in Peru, speaking highly of their own good cotton.

Soon afterwards "Mr. Brown," an evening assistant of the author's, went to "Lima" as a textile mill foreman.

Dyeing of Cotton Yarn.

An ordinary spinner or weaver will learn just a little of the most rudimentary principles of dyeing from the following example of work done by a student in the B.T.S. Textile Department:—

A small bottle of red dye in powder was supplied pre-war by a German firm, amongst many other samples.

Two double hanks of yarn were taken, as spun in the school from Egyptian cotton, one part mule-spun 38's, and the other part ring-spun 26's, and harder twisted.

A suitable pan was placed on a gas stove and the yarn boiled for 30 minutes in clean water with the addition of a small portion of common soda.

The yarn was then well rinsed in cold water and ready again for immersion in the pan now containing a sufficient supply of fresh clean water got to the boiling point.

Before immersing the yarn a good tablespoonful of the red dye powder was well stirred in the liquid and the effect tested upon a small piece of yarn.

With a moderate amount of stirring to secure a uniform effect

all the yarn was kept in the dye for 20 minutes, and then the gas was turned off and the liquid allowed to cool off for 10 minutes or more.

Afterwards the yarn was rinsed in cold water with the addition of a little common salt to harden or fix the dye. A second rinsing and wringing was deemed sufficient, and afterwards the yarn was hung up to dry. Later on the yarn was used for some of the students' cloth designs and gave very satisfactory results, although this was simple direct dyeing without bleaching, and only doing what is done in every home with the small packets of household dyes.

Uniform List for Weaving Mills: Looms.

Through all the extreme variations of prices for work done that ruled through the Great War and several subsequent years, the standard price lists for spinners, card-room hands, winders, weavers, and other cotton operators have remained as the basis, and increases or decreases have been made on the pre-war basis.

For example, most cotton operatives got up to a maximum of 215 per cent. increase for same amount of work, or 315 pence was paid instead of 100 pence specified in the list basis.

At the time of writing (Dec., 1922) quilt weavers are paid 90 per cent. on the list, towels and uniform list people 95 per cent., winders 95 per cent. Operatives in the spinning mills are also 90 to 95 per cent. on the list basis.

The weaving standard of the uniform list is based on an ordinary loom, 45 inches in the reed space, measured from the fork grate on one side to the back board on the other, weaving cloth as follows:—

Width: 39, 40, or 41 inches.

Reed: 60 reed, 2 ends per dent, which means 60 warp threads per inch of reed width, 15 picks per $\frac{1}{4}$ inch, as found by calculation, with $1\frac{1}{2}$ per cent. added for contraction.

Length: 100 yards measured on the counter. Any length of lap other than 36 inches to be paid in proportion.

Twist: 28's or any finer counts.

Weft: 31's to 100's inclusive.

Price: 30d. or 2d. per pick.

"A 45-inch reed space loom being taken as the standard, $1\frac{1}{2}$ per cent. shall be added for each inch up to and including 51 inches; 2 per cent. from 51 up to 56 inches; $2\frac{1}{2}$ per cent. from 56 to 64 inches; 3 per cent. from 64 to 72 inches. $1\frac{1}{4}$ per cent. shall be deducted for each inch from 45 to 37 inches inclusive; and 1 per cent. from 37 to 24 inches, below which no further reduction shall be made."

All looms shall be allowed to weave to within 4 inches of the reed space, but whenever the difference between the width of the cloth and the reed space is less than 4 inches, it shall be paid as if the loom were 1 inch broader, and if less than 3 inches, as if it were $2\frac{1}{2}$ inches broader.

There are allowances for cloth 7 to 15 inches narrower than reed space.

In 1920 it was agreed that in reeds for plain cloths only: "A 60 reed shall be the standard below which there shall be no reduction; $\frac{3}{4}$ per cent. shall be added for every two ends or counts of reed from 60 to 68, 1 per cent. from 68 to 100, $1\frac{1}{2}$ per cent. from 100 to 110, and 2 per cent. from 110 to 132."

Cloths woven one end in a dent to be paid $\frac{3}{4}$ of the reed—thus an 80 reed one end per dent would be paid for as a 60 reed.

There are additions for high picks and deductions for low picks.

The standard for twist being 28's or finer, there shall be additions when coarser twist is woven in the reeds. Example: Between 28's to 20's in 64 to 67 reed inclusive, 1 per cent., in 72 to 75 reed inclusive, 3 per cent.

In regard to weft on ordinary pin-cops, the standard being 31's to 100's inclusive, shall be reckoned equal.

Above 100's, 1 per cent. shall be added for every 10 hanks or fraction thereof. For numbers lower than 31's a table is given, as for example for 19's to 18's add $10\frac{1}{2}$ per cent.

For weft spun into large cops so there are not more than 22 in one pound, additions as per table shall be made in place of the ordinary allowance for pin cops. E.g. for 19's to 18's add 6 per cent.

There are extensive clauses for dhooties in the uniform list, one ruling that 10 per cent. shall be added upon all lengths without any deduction being made for width of cloth, plain dhooties.

Other clauses affect dobby dhooties, Calcutta headings, Madras headings, Bombay chocolate headings, Madras chocolate, and Madras sarrie heading.

There are abundant clauses relating to very many details some of which are specified below, but for exact details reference may be made to such books as Mr. John Taylor's of Blackburn—"Uniform list of prices."

Points dealt with relate to: Herring-bone twills, coloured edges or borders, splits, dobby dhooties, coloured picks, figured cloths, shawl headings, sateens, jeans, jeanettes, drills, drillettes, florentines, pick finding, coarse twist in fine healds, sateens made with more than five staves, plain handkerchiefs, stripes, mock lenos, lace brocades, cotton crimps, saccharilla headings, gold headings, coloured handkerchiefs, grey checks, worsted goods. Weft of 40's

botany, or Leicester botany, demi-lustre, mohair and alpaca, jacquards.

By the Colne weavers list, knop, slub, and Chenille wefts used in check looms, extra shall be paid to weavers, equal to 10 per cent. down to and including 12's weft, and 15 per cent. below 12's weft.

For weft bleached in the cop, all counts, in stripe looms only, 2½ per cent. extra shall be paid.

For tappets, one row of needles 90 per cent. extra; two rows of needles 100 per cent. extra to be paid.

Mule Yarns; Winding Prices; Basis Laws (Blackburn).

Up to and including 39's counts.

Ordinary cops below 14 in 1 lb. weight.

Bastard cops 14 and not to exceed 19 cops per lb. weight, 20·833 per cent. extra or 1s. 2½d. per weigh.

Pin cops over 19 cops in 1 lb. 37·5 per cent. extra, or 1s. 4½d. per weigh.

For over 39's counts, up to and including 64's counts, ordinary cops below 14 in 1 lb. shall have 1s. per weigh. Bastard cops 14 and not to exceed 19 cops in 1 lb. 12·5 per cent. extra or 1s. 1½d. per weigh. Pin cops over 19 in 1 lb., 25 per cent. extra or 1s. 3d. per weigh.

Counts of Yarn.	Lb. of Twist for 12d.	Counts of Yarn.	Lb. of Twist Wound for 12d.
18's yarn . . .	55 lb.	40's yarn . . .	31 lb.
20's ,, ...	52 ,,	46's ,, . . .	27½ ,,
22's ,, ...	49 ,,	50's ,, . . .	26 ,,
30's ,, ...	38 ,,	70's ,, . . .	19 ,,
36's ,, ...	33½ ,,	90's ,, . . .	14½ ,,
38's ,, ...	32 ,,	100's ,, . . .	13 ,,

Intermediate counts in proportion.

The Blackburn list was adopted 17th August, 1853, and since then, like all other wage lists, has been often subjected to increases or reductions on the basis.

Drawing Grey. (*The reed understood to mean counts.*)

Plain 4 staves	up to 80's	reed . . .	5¼d. per 1000 ends
,, 4 ,,	81's ,, 90's	,, . . .	5½d. ,, ,, ,,
,, 4 ,,	91's ,, 100's	,, . . .	5¾d. ,, ,, ,,
,, 1 stave	over 100's	,, . . .	1s. 4d. ,, ,, ,, extra.

Every 10 counts of reed or fractional part thereof.

Handkerchiefs—2 in a width	5¾d.
,, 3 ,, ,, ...	6d.

There are special prices for all kinds of variations in the warps and cloths; as for example :—

Drillettes and sateens 3, 5, 6 or 7 staves, 3 ends per dent = 7¼d.

Plain, one colour 6¼d.

(Let it be always understood that all these lists are basic rates only and actual prices are now usually so much per cent. on these.)

Twisting Grey (Blackburn).

Plain 4 staves 26's to 28's twist	4d.	per 1000 ends.
Coarser than 26's and over 80's to 90's	4¼d.	,, ,, ,,
Plain 4 staves over 90's to 100's	4½	,, ,, ,,
Plain 4 staves over 100's	5d.	,, ,, ,,
All stave work including other than 4 staves	5½d.	,, ,, ,,
Herring bones with flats in	5½d.	,, ,, ,,
Tape stripes 4 staves plain (all yarn counted)	4¾d.	,, ,, ,,

Relating now to Jacquard work. Ordinary one beam,

Leased and loom front taken out for drawer	1s.	per 1000 ends.
Unleased loom front taken out for drawer	1s. 6d.	,, ,, ,,
Redenting takes twisting price.		
Redouping and redenting combined (leno healds in front of harness	1s.	,, ,, ,,

Leno-Jacquards both twisting and drawing are paid time-work.

Time-work and minimum price per hour.

Drawer-in room, not less than 8d.; in shed, not less than 6½d.

Twister-in room, not less than 6d.; in shed, not less than 6½d.

In all cases shall ability be recognised, and when either twister or drawers average earnings per hour gives more than the minimum price stated, then payment shall be made according to ability.

Notes.—(*a*) When the ends, which are drawn through the healds on one hook, are not put in the same dent—this constitutes split drafting.

(*b*) When there are more than two healds to one dent—this constitutes cramming, but would not apply to warps which are drawn three to four ends in a dent throughout the warp.

(*c*) In fixing up prices for any sort not provided for in the list, the basis shall be calculated from the 5¼d. for drawing, and 4d. for twisting, per 1000 ends.

In 1906 it was agreed that the so-called Blackburn list should apply to the districts of Blackburn, Preston, Chorley, Darwen, Accrington, Padiham, Ramsbottom, Haslingden, Clitheroe.

(*d*) Overlookers of weavers are mostly paid poundage on the following list basis ruling about 1896.

Poundage.

	Blackburn.	Burnley.
Ordinary shirtings	1s. 4d. to 1s. 5d.	——
Jaconettes	1s. 4d. ,, 1s. 5d.	——
Twills	1s. 4d. ,, 1s. 7d.	1s. 3d. to 1s. 5d.
Stained work	1s. 6d. ,, 1s. 8d.	——
Dhooties	1s. 4d. ,, 1s. 6d.	1s. 3d.
Dobbies	1s. 5d. ,, 1s. 10d.	1s. 4½d. ,, 1s. 9d.
Plain cloths	——	1s. 1d. ,, 1s. 3d.
Jeanettes	——	1s. 3d. ,, 1s. 5d.
Splits	——	1s. 2d. ,, 1s. 9d.
Drills	——	1s. 3½d.

Burnley List Prices: Beaming.

For beaming 400 ends, 17,500 yards, 5 warps, the payment as below:—

4½d. per beam for creeling and 4½d. for each warp, irrespective of counts of warp yarn.

For every 10 ends, or fraction thereof, ½d, up or down, but no deduction below 370 ends.

Eg., For 400 ends, 5 warps, 17,500 yards, the price will be: 2s. 1¾d. per beam, including creeling.

Operative required to turn the beam back to find broken ends.

Winding: For Winding 60 lb. of Warp Yarn.

16's to 18's counts	1s. 4½d.	40's to 42's	2s. 0½d.
20's ,, 22's ,,	1s. 6¼d.	44's ,, 48's	2s. 2d.
24's ,, 26's ,,	1s. 7½d.	50's ,, 52's	2s. 3½d.
28's ,, 30's ,,	1s. 8¼d.	54's ,, 58's	2s. 5d.
32's ,, 34's ,,	1s. 9½d.	60's ,, 62's	2s. 6½d.
36's ,, 38's ,,	1s. 11d.		

Intermediate counts to be paid in proportion.

Rules for Settlement of Disputes.

Disagreements and disputes in regard to wages, work, and various mill conditions, have been very frequently indeed, settled by secretaries, chairmen, delegates and committee men, without reference to the disturbing arbitrament of strikes and lock-outs. All sections of the cotton trade may have this general remark applied to them, including card-room, spinning, weaving, winding, bleaching, and general workers.

The Amalgamated Weavers' Association have joint rules with other associations for the settlement of trade disputes in the weaving, winding, and warping departments, in the early stages, so as to preserve good feeling between employers and employees.

It is a leading feature of the association rules that in the event of a trade dispute, and before either side shall give notice of termination of employment for the purpose of a strike or lock-out, the dispute shall be brought forthwith before a local joint meeting of both sides. Such meeting to be held within four days of application for it—not counting Sundays.

Failing a decision by above meeting and before the extreme step is taken there shall be a meeting between representatives of the Amalgamated Weavers and of the North and North-East Lancashire Cotton Spinners and Manufacturer's Association, meeting to be held within seven days of application by either party.

Even after above two deliberate and arranged meetings, before stoppage notices are sent out, there shall be a joint meeting of the representatives mentioned in the last clause of the Northern Counties Textile Trades Federation, meeting to be held within seven days of application.

After this last meeting and failing agreement, either party may take its own measures. When there are complaints of inferior material local secretaries are ofen able to settle the affair, but failing this the operatives' secretary may call for a joint inspection by both sides of the work in question and such inspection should take place within 3 days—not counting Sundays.

The joint inspection failing to reach a settlement then further procedure may follow the lines suggested in the foregoing notes.

Alleged cases of under payment may be investigated along somewhat similar lines.

Applications by either employers or operatives for a sectional or general alteration in prices or wages and not agreed upon otherwise, shall, before notices are given by either party to terminate employment, for lock-out or strike, be brought before the joint authorities referred to section on disputes, much the same procedure must be followed, meetings also to be held within same periods.

It need scarcely be added that all such meetings must be regarded as strictly private and confidential, until settlements are definitely reached.

Disputes.

In regard to disputes amongst Bolton and district spinners, every precaution is taken on both sides to obtain a settlement before resorting to a strike or lock-out.

If matters are considered unsatisfactory at any mill a report may be given to the mill shopman and the matter may reach a shop meeting, and a small deputation selected to wait on the management to talk the matter over. Usually an agreement is arrived at without further proceedings.

Sometimes the business in dispute must go somewhat further and a report given by the shopman to the general committee, who may send the general secretary to interview the mill management.

Failing agreement a more general meeting may be called and stronger steps be taken. The Executive may deem it necessary to report the matter to their Federation, who may hold joint meetings with representatives of the Master's Federation.

A strike or lock-out is the final step after more or less protracted proceedings have been taken and the original mill trouble has become a district matter and even a general amalgamation matter, with more or less independent referees.

Practical experts have been utilised for some years to decide whether any serious complaints of bad spinning are justified or not.

Other Lists.

The references to wages lists in this treatise are designed only to deal with principles of payment, and for exact information, up-to-date readers are referred to various officials.

Cotton weaving covers too wide a range of cloths to have a uniform list of wages and conditions suitable for all districts and all sorts of cloth. Absolutely plain grey cloths and twills at one big end of the trade, up to fancy brocades from Jacquard looms; narrow width and simple cloths up to the widest of cotton blankets and bed quiltings, with all kinds of special effects between, combine to increase the difficulties of a uniform list.

Important districts like, Colne, Burnley, Bolton, Bury, Ashton-under-Lyne, Hyde, and Glossop, sometimes adopt the uniform list for certain sorts only, or have lists of their own.

For example, the Bolton and district standard lists have special reference to the weaving of toilet and Marseilles, honeycomb, alhambra, tapestry and other quilts; also toilet and satin covers.

At the time of preparing these notes (Nov., 1922) the lists are well administered officially by representative chairmen and committees, having Mr. J. Dewsnap as master's secretary and Mr. C. Speak as operatives' secretary. Mr. J. Ainscow long acting as master's chairman.

By the Bolton standard all looms over 72 inches wide are to be reckoned as full quilt looms. All looms over 56 inches, up to and including 72 inches wide, to be reckoned as crib quilt looms.

All looms 56 inches wide and narrower to be reckoned as cover looms.

In regard to empty reed space, the measurement of looms shall be from the weft fork grate on one side to the back board on the other side. No extra payment to be made until the empty space

exceeds 15 inches, on looms over 72 inches wide, 12 inches on looms 57 inches to 72 inches inclusive, and 10 inches on looms 56 inches and below.

There are many special clauses of which a few examples only are quoted to indicate underlying features.

(*a*) For toilet and satin quilts woven with two shuttles the basis shall be 24 reeds (3 ends per dent), 6 diamonds (72 picks), 99 inches × 99 inches (9801 square inches), price 10½d. 1½d. per diamond (⅛d. per pick) to be added or deducted for each additional diamond above or below six. 3 or 4 picks to card to be paid in proportion for picks. . . .

Add ¼d. for every additional count of reed.

Deduct ⅛d. for every count below 24 down to 20.

Welts to be paid 1d. in 1s. extra to plain cloth.

Pick and pick quilts to be paid 12½ per cent. extra.

Quilts woven with fringes at the ends or sides to weave fine picks less for ⅛d.

Bleached or coloured warp 1d. in the 1s. extra to grey. Bleached or coloured weft ½d. in the 1s. extra to grey.

Marseilles quilts woven with two shuttles have several special clauses :—

Basis. 28 reed, 10 cards to inch, 10 picks to card, 108 inches × 108 inches, price 17½d.

Picks. 1½d. added per each card in inch over 10 cards.

Reed. Add ¼d. per count up to 36 reed.

Toilet and satin quilts woven with one shuttle, unicus quilts, ariel quilts, dimity quilts, figured dimity quilts and crib quilts, all have bye-laws of their own. This remark is even more true about honeycomb and alhambra quilts, as well as tapestry quilts.

Turkish and Other Towels.

Towel weaving is rather a specialised line of work, subject to prices and wage bye-laws suitable thereto. Conditions agreed to in September, 1913, were signed by Mr. John Ainscow, Chairman of Manufacturers at Bolton, Mr. Wm. R. Lee, Chairman of Manufacturers of Heywood, and Mr. Joseph Cross, Secretary of Northern Counties Weaver's Amalgamation. Subject to 5 per cent. advance, January, 1914, subject to 155 per cent. advance, June, 1921, and 145 per cent., December, 1921, and to various reductions since that date.

The chief clauses of the list are summarised below, the standard for weaving to be cloth standing 30 inches of yarn in the reed, in a 36-inch reed space loom. Fractions ½ inch and over to be called one inch.

The reed to be 40 to 50 Stockport, both inclusive, to include all twist or warp yarns that are used, and for weft of 12's counts or finer.

The price basis of 3200 picks for 1d. or 3·75 for 12,000, and all picks to be paid for.

Other widths to scale. If less than 6-inch empty reed space the grey to be for actual width of yarn in reed, but if more than 6 inches empty reed space, then such space to be counted $\frac{1}{2}$ as yarn space.

All reeds above 50 Stockport to have $\frac{3}{4}$ per cent. per 2 counts of reed added, and all reeds below 40 Stockport to have $\frac{3}{4}$ per cent. per 2 counts of reed deducted.

One per cent. for each count of weft as used in the body, to be added below 12's.

Linen towels to be paid 15 per cent. on the list.

Lettering Jacquard double lift 15 per cent. on the list.

Full figuring harness Jacquard double lift, to be paid 25 per cent. on the list.

Box looms working extra shuttles to be paid 25 per cent. on the list. Special bleached fancy towels to be paid 5 per cent. on the list, this applying to towels made from all bleached or dyed warps and wefts, single splits with machine selvedge to be paid 5 per cent. on the list.

Terry cloths to be paid 5 per cent. off the list.

Honeycomb towels 30 per cent. off the list.

Dobbies up to 7 staves no extra, but over 7, one per cent. per stave. Prices paid to nearest $\frac{1}{8}$d.

Add to each price $\frac{1}{8}$d. per change per dozen towels for each time a shuttle is changed by the weaver in weaving one heading for 30 inches yarn space and below. Additions and deductions to be made in specified order to get exact percentages.

Cloths in Different Districts.

Printers and lumps	are	much	woven	in	Burnley	District
Dhooties	,,	,,	,,	,,	Blackburn	,,
Fustians	,,	,,	,,	,,	Bury	,,
Quilts, towels, and fancies	,,	,,	,,	,,	Bolton	,,
Towels	,,	,,	,,	,,	Heywood	,,
Hard waste cloths	,,	,,	,,	,,	Haslingden	,,
Backing cloth for oilcloth	,,	,,	,,	,,	Lancaster	,,
Sateens	,,	,,	,,	,,	Nelson	,,
Longcloths, sateens, lenos, and tappets	,,	,,	,,	,,	Preston	,,
Velvets	,,	,,	,,	,,	Oldham	,,
Sheetings	,,	,,	,,	,,	Hyde	,,
Coloured goods—either plain or fancy	,,	,,	,,	,,	Colne, Radcliffe, and Walkden	District
Fine cloths and mulls	,,	,,	,,	,,	Leigh	,,

Automatic Looms.

"Just before the war I stood in a small department of a mill. There were 60 automatic looms. A man and a woman attended to them; the man had 35 looms, the woman 25. They went to dinner. I stayed behind. The looms were left running. In half an hour I counted the looms still running—there were 40. . . ."

". . . I have seen automatic looms with a box filled in the warehouse, and which, when placed on the loom, would enable the same to be automatically replenished with weft for a week. It is perhaps not generally known that automatic looms can be fitted to run in the dark, and when anything takes place which stops the loom, the light is immediately turned on and switched off automatically the moment the disturbing factor has been remedied and the loom restarted. . . ."

"Taking the case now of the ordinary complicated looms mentioned, and others with fewer automatic motions, there is work for a whole century for technically trained coming generations to add further automatic arrangements to make human labour more effective."—Oscar S. Hall.

Trade Generally.

Broadly speaking trade in yarn and cloth is comprised in the two great divisions of home trade and foreign trade.

The home trade is affected greatly by the inland carrying trade, and foreign trade is affected still more greatly by the shipping trade. Rates of exchange and parities have greatly upset trade since the war, as well as high transit charges.

The import trade affects cotton businesses most directly in regard to raw cotton, while the export trade refers chiefly to cotton yarn, cotton cloth, and cotton waste.

The Eastern trade refers, chiefly to trade with China, Japan, India, and the East more generally, while the near East refers more especially to such countries as Rumania, Greece, Turkey, the Levant trade perhaps more definitely referring to Syria, Asia Minor generally.

There is Canadian trade, Australasian trade—meaning also New Zealand—Baltic trade, Black Sea trade, and Continental trade, the latter meaning such European countries as France, Germany, Norway, Sweden, Denmark, Italy, Switzerland, Belgium, Holland, and Austria.

Jamaica, Cuba, and other islands, are included in the West India trade, while Central American trade includes Mexico and other countries. Trade with the "States" means United States, and

under the general expression of North American is often meant both the U.S.A. and Canada.

Brazil, Peru, Chili and other places are included in South American trade.

By term "Balance of Trade" may be meant the relation between our total exports and imports.

When our exports are less than our imports in value the balance of trade is said to be against us, but this state of things never applies to the British cotton trade taken as a separate trade. Value of imports may exceed value of exports without this meaning a loss to Great Britain.

"Producers" are cotton planters, cotton spinners, weavers, bleachers, dyers, finishers and machinery makers.

"Intermediaries" are cotton, yarn, machinery and accessories agents and factors.

Distributors are cotton merchants in Liverpool and Manchester, yarn and cloth shipping houses in Manchester.

Bankers, railway, motor and shipping transit people are very important auxiliaries.

Goods may be sold such as (*a*) delivered at our works; (*b*) delivered at station; (*c*) free on rail (F.O.R.); (*d*) "free alongside," or free up to ship's side; (*e*) F.O.B. (free on board); (*f*) C. and F., that is the price of goods shall include all charges up to end of ship's journey excepting insurance, while C.I.F. or C.F.I. includes also insurance; (*g*) Franco includes C.I.F. plus costs up to door of purchaser, meaning import duty and cost of transit in the town or country abroad.

"Landed terms" means all dock dues, porterage, etc.

The term "In bond" seldom applies to cotton, cotton yarn or cotton cloth, and means that the goods are placed in one of the bonded warehouses, waiting for the buyer to pay the customs or excise duties.

Ex-quay means that the buyer takes charge and pays fees after the goods are delivered on the quay.

A "Prompt" sale requires the goods to be paid and taken over on a date specified, known as the "prompt" day.

"Prompt delivery" requires the goods to be delivered in a few days more usually.

"15 June shipment" means goods must be shipped not later than 15th of May.

"Free overside" means less than "Ex-Quay," since the buyer must then provide lighters to take the goods direct from the ship's slings.

"Duty paid" means that the customs duties have been paid by the seller.

"Spot cotton" means cotton actually at Liverpool or Manchester, as distinct from "to arrive," which means the cotton is to

be delivered when its vessel reaches port. "To arrive usually" requires the vessel to be specified.

C.O.D., Cash on delivery. "Prompt cash" requires payment in a day or two without discount.

"Sale by sample" requires that the bulk shall agree in quality with the sample, and the purchaser shall have a reasonable chance to compare sample and bulk.

"Near delivery" implies delivery within a short time, as distinct from "Forward delivery," which may mean in some future month three or four months ahead.

Lien: when a yarn seller has delivered part of an order and not got paid at proper time, he may refuse further delivery, or exercise a "lien" or right of detention.

An unpaid seller may also stop goods in transit and have them returned.

Either buyer or seller refusing to fulfil his part of the contract may be sued.

Methods of payment are as follows: (*a*) actual cash; (*b*) cheque; (*c*) bills of exchange payable in the country of debtor; (*d*) bonds or international securities sent for sale; (*e*) sending other goods of equivalent value.

The "rate of exchange" is the price paid in one country for the money of another country.

For example on 14th December, 1922, an English sovereign was worth 19s. 2d. in New York, whereas at a period in 1920 it dropped to 14s., and pre-war it was worth its face value in America.

An Indian rupee often varies in value as related to an English sovereign, as for example if it is quoted at 1s. 4d. or 1s. 3d., the bank in Bombay will pay one rupee for that 1s. 4d. or 1s. 3d. payable in London.

Transit: road, rail, canal, river, coasting vessels on the sea, have long afforded good means of transit in this country.

In the middle of the last century it is stated that stage coaches took a fortnight to run from London to Edinburgh under the best of conditions.

Nowadays a man takes a Scotch express in London after having his tea, and may get an early breakfast in Edinburgh next morning.

Motors and motor wagons give rapid road transit. Aeroplanes will divide the time of the rail expresses by two. Canals have diminished in use very greatly.

"Short Exchange" implies cheques or bills payable on demand or "on sight." "Long Exchange" is a term applied to bills drawn for "term"—possibly of three months or other suitable period.

Low Grades of American Cotton.

Bales of undesirable grades of cotton accumulate every season, and need not be of shorter staple than average. More often the quantity of undesirable matter present in the cotton, and the amount of discoloured cotton give the low grading. A Memphis report quoted twenty grades, of which eleven were not of sufficiently high grade for delivery against a "futures" contract.

An American system of dealing with such undesirable elements is referred to below.

A Hopper bale-breaker is followed by a Hopper feeder. The cotton is next treated in something like the same manner as elsewhere described for gun-cotton at Queensferry. A drying chamber of about 20 yards length is heated by steam-pipes. The cotton is helped through the chamber by means of fans, and it is found that the cotton will part more rapidly from its foreign and undesirable elements, when the cotton is in a warm, dry condition. Subsequent treatment involves the use of two or three Crighton openers. A baling press is afterwards used and a fine spray of moisture played on the cotton to make up for what has been lost in the conditioning chamber. The comparatively small crop of dirty pima or American-Egyptian cotton cleaned readily on above system.

Faulty Woven Fabics.

There are very many ways in which woven cotton cloth may be faulty, and it is a common saying amongst weavers, that they have to make everyone else's bad work into good.

It may occasionally happen that particles of seed reach the cloth, and if so, will probably stain the cloth. A good weaver will produce better cloth than a poor weaver from the same warp and weft, but cannot be expected to remedy faults due to bad yarn or looms out of order. Bleaching before dying is an excellent preventative against some undesirable matter spoiling the cloth in the finishing processes.

Snarled weft in American cotton too often reaches the weaver. Nicked cops should be avoided by spinners, either by not leaving the ends down so long, or else by pushing the cops up into exact winding-on line with all others. Dyeing without bleaching may be cheaper, but is very liable to show dark specks in the finished cloth.

If grandrelle yarn is produced by twisting unequal threads together the effect will be seen in the cloth.

It is a frequent fault for the lower ends of cop tubes to get stained with oil and to affect portions of yarn, but more careful

oiling of the spindle "tops" or bolsters would prevent this, and stop a good many complaints of oil stains in the cloth.

Taping faults are often due to wrong materials, or wrong proportions of materials, or unsatisfactory mixing of the size ingredients, and if any person needs to be careful and skilful in a weaving mill it is the slasher sizer, whose work affects so many weavers to such a large extent.

Cop dyeing is not always as thorough as hand dyeing of yarn. "Shady" weft may even be due to using "weft-way" yarn instead of twist way.

Egyptian Cotton Cheaper than American.

For several weeks in June and July of 1923 it was possible to purchase some Egyptian cotton in Liverpool or Manchester at a less price than good American. For example, a manager informed the author that he had bought Egyptian cotton for 36's carded twist 1d. per lb. less than he could get sufficiently good American. Also he had bought Egyptian for 76's carded yarns at the same price as given for American to spin 36's. This position made it very bad for spinners of American yarns.

CHAPTER XII.

VARIOUS NOTES.

Montgomery Quotations.

James Montgomery's treatise on cotton spinning was written in 1832, or more than ninety years ago. There is surely educational value in quoting a few passages therefrom, so that present-day ideas and practice may be compared with what obtained almost 100 years ago.

(*a*) *Mill Planning.*—"The body of the mill itself is supposed to be 145 feet long and 37 feet wide within the walls; and supposing it to be six stories high, would be capable of containing 23,000 spindles, with all the necessary preparation for average numbers. It would require an engine of between 40 and 50 horse-power to drive a mill of this extent. . . . This mill will be neither too large nor too small."

(*b*) *Cotton Mixing.*—"The first thing to be done with the cotton previous to its being put into any machine whatever, is to mix together a number of bags all in one heap, commonly called a bing or bunker of cotton, the necessity for which arises from the great variety in the different bags, from which it is impossible to produce a yarn of uniform quality, unless a number of these are all incorporated together. To make up a bing of cotton properly is a matter of great importance."

(*c*) *Carding.*—"By him, also (Arkwright) the carding engine was greatly improved . . . he substituted a metal plate toothed at the edge like a comb (the doffer comb), which instead of being revolved like the other, was moved rapidly in a perpendicular direction by a crank, and with slight but reiterated strokes detached the co ton from the cards in a uniform fleece. In place of the sheet cards with which the doffer had hitherto been covered, he employed narrow fillet cards wound round it in spiral form; by this contrivance a continuity of the cotton fleece was assured.

Finishing Operations.

1. "Stentering" or stretching.
2. "Filling" by the addition of stiffening matter.
3. "Softening" of the cloth.

4. "Calendering," or pressing the cloth between hot rollers in order to produce a smooth, glossy finish.

5. "Beetling," which has some relation to calendering, because it is designed to give linen-like appearance and feel to the cloth.

6. "Raising" by means of steel wire brushes on cylinders and rollers, which produce a nap or soft woolly surface on the face of the cloth.

7. "Gassing" of cloth in fundamental principle resembles the gassing of yarn in that it burns off loose fibre, rough ends or knots, the gas exposure being sufficient to do this without burning the cloth itself.

8. "Mercerizing" has become popular both for cotton yarn and cotton cloth, and imparts a durable lustre.

9. "Polishing" also gives a lustre or glaze to cloth.

10. Finally, cloth making-up may be done in a manner suitable to markets and customers. The cloth may be doubled, plaited, made-up into long or short lengths, stamped, ticketed, tied with tape or string, parcelled and packed ready for sending away.

Calico printing is an important industry, and has been defined as a form of dyeing in which one or more colours are applied to cloth in certain parts only and in definite pattern. Various methods exist, but a leading method is by means of engraved rollers. Engraving of the rollers is a highly skilled business.

The engraving processes may include preparation of the designs, making of die or stamp for reproducing the pattern on steel cylinder or mill, and the engraving by this "mill" of the pattern on the copper roller.

Preparation of cloth for printing includes brushing and shearing to give a smooth surface to the cloth, also stretching, and winding round hollow wooden or iron centres into rolls ready for the printing machine mounting.

At the printing machine the cloth makes contact with the engraved copper roller, which has received the required amount and kind of dye from a colour box fixed below. In this way the pattern is given to the cloth.

A thin, sharp steel blade resting on the copper roller scrapes off superfluous colour. Each colour requires a separate roller.

Subsequent processes are concerned with cloth cleaning, fastening the colours, drying, plaiting, and making-up.

Trading Terms.

"Longs" or "Bulls" are those persons who buy cotton, or at any rate "Futures" contracts, in the hope or belief that prices will increase.

"Shorts" or "Bears" are the opposite of "Bulls," these

"Bears" selling cotton in the belief that prices will go down. They sell without actually having the cotton.

A term sometimes used as "Stop Loss Limit," defined as selling out a cotton contract, at a stated price lower than the purchasing price but not lower than the limit specified.

The "Straddle" implies selling Futures for one month and buying about the same weight for another month, believing the further alterations in prices will favour the change.

The Straddle may refer to Futures in two markets, or different months, or even different growths.

"Actual" means that the definite length of yarn or cloth ordered will be required.

"Nominal" implies that the yarn counts or the cloth ordered may vary somewhat from the specification.

Cotton Hair or Cotton Fibre, Cotton Wax.

It may be noted that in a publication of the British Cotton Industry Research Association early in 1923 it was stated that from a Botanical point of view the term "Cotton Hair" was preferable to "Cotton Fibre" and would therefore be used in all communications from their Institute.

Apparently there has not been much really reliable information available in regard to what is termed "Cotton Wax."

It is considered to be a very good thing in actual spinning of cotton, but it is deemed to be of importance to obtain its removal in bleaching of cotton, yarn or cloth.

It may be taken for granted that the highly trained and devoted men of the Research Association will shed better light on various points relating more or less to cotton wax.

It has been stated that cotton wax is without odour, has a colour of dull yellow and has a resemblance to beeswax.

It has always been understood that in a correct spinning room temperature—say 75° to 90° F.—the cotton softens and helps to make it more readily workable into spun yarn, while subsequent cooling of the yarn tends to set the wax and to strengthen the yarn.

Actual experiments with cotton deprived of cotton wax showed up in extra waste, more thread breakages and greater tendency to roller lap.

Investigations can be made, and have been made, of cotton and cotton goods damaged in such ways as the following:—

"Country damaged," mildewed cloth and yarn, damage by the boll-worm to pods and fibres, damage to seed-cotton. It has been proved that distinct injury may be produced even before growers, factors and spinners are aware of it. Care should be taken against

storing yarn or cloth against damp walls or in any damp and badly ventilated places; in the kinds of materials used in sizing of yarn, conditioning or other treatment, micro-organisms may develop at various stages.

Air Transport.

In connection with travel and transport in the Manchester area reference may be made to the possibilities of air service.

Passenger traffic is perhaps more concerned at present but not exclusively so.

A daily Manchester-London air service was established using 10-seater aeroplanes driven by engines of 450 horse-power.

Planes timed to leave the aerodrome at Manchester 9 to 10 A.M. each day and do the return journey in the afternoon same day.

The quick-time journey of 80 minutes has been done on at least one favourable occasion.

Manchester business houses have used this service to a fair extent, but more custom is needed to make it pay.

From London, of course, a Manchester air passenger may continue his air passage to the chief continental cities.

It is presently hoped to establish an air service between Manchester and Birmingham to do the trip in less than an hour.

Considerable attention has been given by various corporations and Government authorities to the question of a fine direct new road between Liverpool and Manchester.

Lancashire Banking Facilities.

The banks of the area covered by the Manchester bankers' clearing house exercise a most important influence on the cotton trade, and this influence is reciprocated so that the commercial importance of this banking centre much exceeds that of any other country area. The great national banks are well represented in Manchester, and there are other banks which have practically grown up in this centre. In Manchester there are also branches of various foreign banks, although the disturbances due to the war have somewhat upset these connections.

Mention may be made of the Lancashire and Yorkshire Bank, Ltd., the Manchester and Liverpool District Banking Co., Ltd., the Williams Deacon Bank, Ltd., the Union Bank of Manchester, Ltd., the Manchester and County Bank, Ltd., Bank of Liverpool and Martin's, Ltd., Barclay's Bank, Ltd., Lloyd's Bank, Ltd., National Provincial and Union Bank of England, Ltd., London Joint City and Midland Bank, Ltd., Westminster Bank, Ltd.

Manchester Cotton Association, Ltd.

This important association was formed in 1894 coincident with the completion of the ship canal. More and more cotton is bought and sold in Manchester, although Liverpool easily retains its supremacy, and the Liverpool Cotton Brokers' Association remains the most powerful of its kind in the world. Recently the membership of the Manchester body was quoted at over 370, including spinners, brokers, and merchants. Both American and Egyptian cottons now often arrive by ship direct at Manchester, the largest weight in one year being given at over 890,000 bales in season 1919-20. Objects of association comprise the adjustment of claims, helping prompt delivery, giving out useful information, and generally to promote direct cotton business in Manchester.

Extracts.—Bolton Operative Spinners' Report for 1922.

"The raising of the age of leaving school to 14 has had its effect on the cotton factories and sheds. In the spinning rooms of Bolton more than 20 per cent. of the mules are understaffed with piecers.

"This is a serious matter, for, when the whole of the industries get into full swing again, it is likely to be a menace to the operative spinner, causing more work and a greater risk of the quality being inferior.

"During the past 20 years great improvements have taken place in the sanitation and ventilation of spinning rooms, yet there is a tendency to avoid employment in spinning mills by boys and girls leaving school."

"Much uneasiness has been caused in the minds of many members and textile workers generally by the repeated agitations raised by a section of employers for a departure from the 48-hour working week which was jointly agreed to in June, 1919."

Two distinguished surgeons drew attention to the prevalence of scrotal diseases among spinners, and visited a cotton mill to investigate. They noted that a spinner in piecing bobbins or broken threads or cleaning rollers often leans forward with the left groin touching the faller shafts. In this way oil gets especially on the thin overalls of the spinner and thence to his body.

It is suggested that the combined effects of the mineral oil and frequent abrasion on one portion of the body may lead to skin irritation and possibly to more serious physical ailment. The warm, humid atmosphere of the mill, the scanty clothing worn by the spinner at work, and tendency to perspire may accentuate the tendency to ailment.

Pre-war Acts of Parliament.

A few Acts of Parliament affecting Cotton Mills are stated below:—

1. The Factory Acts, 1833 and 1895.
2. Employers' Liability Act, 1880.
3. Workmen's Compensation Act, 1906.
4. Old Age Pensions.
5. Trade Union Act, or Charter of Trade Unionism, 1871.
6. Trades Disputes Act, to safeguard Trade Union funds and make it legal to employ peaceful picketing.
7. Trade Unions Act, 1913, which made it possible to have a special fund for political purposes, but not to be compulsory in subscriptions thereto.
8. The institution of Trade Boards by means of the Trade Boards Act of 1909.
9. National Insurance Act, 1911.

Craft v. Trade Union.

An ordinary modern Trade Union collects membership contributions, employs a highly expert secretary and assistants to conduct negotiations in regard to alleged bad work, unjust mill dealing, and matters affecting wages and work generally governed by such rules as each society chooses to make. There may be out of work pay, payment for stoppage through breakdown, bad trade, or accident. Some Trade Unions have superannuation benefits.

Trade Unions are combinations of work people to enable them to resist wages reductions, and bad mill conditions, or to enforce wages increases when trade conditions permit. Some ordinary Trade Unions of work people, such as spinners and weavers, do little or nothing in the way of limiting apprentices or number of learners. Trade Unions often take part in public movements such as the Shirley Institute, the Cotton Growing Association, Labour candidates for Parliament. Broadly defined, a Craft Union may be one confined to members of one particular branch of Industry. An Industrial Union may be a combination of various Craft Unions, or may be a Union which takes workers of any kind of trade.

More strictly a *Craft Union* may be defined as one which adopts measures to restrict the number of learners or apprentices, and which more or less jealously prevents the work of its members from being freely and openly taught to all who care to learn.

There is not a great deal of this in the cotton trade, but Power-loom Overlooker's Societies, ball-warpers and slasher seizers have done something in this line. Some cardroom associations have rules restricting number of learners for grinding and insisting that a man must not become a grinder until after one or two years as a card tenter and until the age of nineteen.

It will be seen that a "Craft Union" goes further than an ordinary Trade Union along this particular line of attempting to prevent an overplus of skilled labour, while it may also adopt more or less of the laws explained above for ordinary Trade Unions.

Peaceful picketing in cases of strikes or lock-outs has been permitted by law for some years.

Development of Trade Unions.

Combinations of operatives in some form or other have existed from the earliest days of the factory system, but the present perfection of Cotton Trade Unionism has been attained by slow and often painful degrees. The members of these early societies had to be very mindful of what they said and did or they were soon apprehended, as combinations of operatives in the same trade for the purpose of increasing wages or taking other action against their employers were deemed unlawful.

More than 100 years ago, however, there were many Friendly Societies amongst spinners and weavers, in which frequent discussions took place regarding work, wages, and mill conditions. Out-of-work money was sometimes paid in one way or another.

By Acts of Parliament about 1800-10 weavers were supposed to be protected somewhat in dealing with employers, but minimum wages clauses have not been enforced by legislation.

More than 100 years ago there were at times very extensive strikes amongst spinners and weavers.

A "strike" may be defined as a mill stoppage by operatives refusing to work unless granted certain concessions. A "lock-out" is a stoppage by employers refusing to run their mills unless certain demands on their part are agreed to by the workers.

Strict Craft Unionism is probably no stronger now than it was 100 years ago, at which time regulations were often adopted limiting the numbers of learners or apprentices, and imposing so many years of apprenticeship service. Operatives were sometimes cautioned against boasting as to amount of wages earned.

Masters' Associations and Combinations—direct and indirect—have always existed to a greater or lesser degree. Prevention of wages getting very high or their productions too cheap have often been amongst the objects of Masters' Combinations.

The author is indebted to Mr. Cephas Speak, secretary of the Bolton Operative Weaver's Association, for the following article.

The Trade Union Acts, 1871-76-1913.

"By the Trade Union Act of 1871, it was declared that a Trade Union merely because its objects were in restraint of trade should

not be held to be unlawful, and its agreements were made binding, so that they should be recognised by law.

"One section of that Act, however, Section 4, has produced a great amount of litigation, for by it the courts are precluded generally from hearing internal disputes between members of the union.

"Two important qualifications have been made by the courts on this section; the first is that, relying on the words of the statute, 'nothing in this Act shall enable the court to entertain proceedings with the object of directly enforcing or recovering damages in inter-union meetings'; it has now been decided that the direct enforcement of an agreement is within the power of the courts.

"Had it not been for this interpretation in the case of the Yorkshire Miner's Association *v.* Howden (1905) A.C. 256, a member of a Trade Union could not have brought an injunction; and the famous 'Osborne' case, which had so many political consequences, might never have been heard.

"The second power which the courts have obtained to avoid the consequences of Section 4 of the 1871 Act, and so hear disputes between members of the Union, is more subtle but not less important. Section 4 of the 1871 Act says, 'Nothing in this Act shall enable any court to entertain any legal proceedings instituted with the object of directly enforcing or recovering damages for the breach of any of the following agreements, viz.:—

"'1. Any agreement between members of a Trade Union as such, concerning the conditions on which any members for the time being of such Trade Union shall or shall not sell their goods, transact business, employ, or be employed.

"'2. Any agreement for the payment by any person of any subscription or penalty to a Trade Union.

"'3. Any agreement for the application of the funds of a Trade Union:

(*a*) To provide benefits to members.

(*b*) To furnish contributions to any employee or workman not a member of such Trade Union, in consideration of such employee or workman acting in conformity with the rules or resolutions of such Trade Union.

(*c*) To discharge any fine imposed upon any person by sentence of a Court of Justice.

(*d*) Any agreement between one Trade Union and another.

(*e*) Any bond to secure the performance of any of the above-mentioned agreements.

"'But nothing in this section shall be deemed to constitute any of the above agreements unlawful.'

"It was usually held that Trade Unions, not being corporate bodies, could not be sued. But the Royal Commission of 1906,

thought that illegality could be no obstacle to suing a Trade Union.

"The difficulty about suing a Trade Union was the want of a method of taking proceedings against a number of persons not forming part of a corporate body, and this was got over in the latter part of the nineteenth century by the institution of the 'representative action' in which a few named members of any group of people having common interests are sued as representing the whole group of individuals.

"This was not confined to Trade Unions.

"But at any rate the unlawful Trade Union could not sue. By the Act of 1871, however, this was legalised, save that, by Section 4, internal disputes are still precluded from the jurisdiction of the courts.

"Now, however, if the Trade Union is *not* acting in the main in restraint of trade (and whether it is so or not is a matter to be decided by its rules), it was never an illegal body, and it could not bring and defend actions at common law like any other association; and in that case Section 4 of the 1871 Act would not apply, as the whole 1871 Act is concerned with legalising Trade Unions which *are* in restraint of trade.

"Consequently, when a member of a Trade Union suing the Union can show that according to its rules it is primarily not in restraint of trade, he can not only get an injunction, but, despite Section 4, can actually recover damages. The leading case in this matter which so settled the law is Swaine *v.* Wilson (1889), 29 Q.B.D., 252. It was under this principle that, in the 2nd Osborne case, the Amalgamated Society of Railway Servants was held at Common Law to be a lawful society not acting in restraint of trade.

"The 1871 Act, and also that of 1876, provided for the optional registration of Trade Unions by the Registrar of Friendly Societies, and nearly half of the Trade Unions in the United Kingdom have availed themselves of this provision.

"An unforeseen consequence of the 1871 Act has been that the definition section of the Act (which has already been slightly enlarged by the Acts of 1876 and 1913) has been treated by the courts as being the Charter under which Trade Unions are legalised, and in the famous case of the Amalgamated Society of Railway Servants *v.* Osborne (No. 1) (1910), it was laid down by the House of Lords that an action of a registered Trade Union which did not fall within the definition section of the 1876 Act was outside the powers of the Trade Union, and unlawful. The House of Lords decided that money spent on parliamentary elections was *ultra vires* or outside the section; and in the case of Wilson *v.* Amalgamated Society of Engineers (1911) a similar decision was given in regard to municipal activity.

"This position continued until 1913, when a further Amending Act gave power to a Trade Union to spend money on any lawful purpose authorised by its constitution, so long as its principal objects were those of a Trade Union, *i.e.* the objects defined in the Act of 1876. A further provision precludes from this general power the financing of certain defined political purposes, and in these cases before such purposes can be added to the constitution of the Union, a secret ballot of the Union members must be taken in a prescribed form and a special right of individual exemption from this particular activity prescribed, and the money to be spent on such political objects must come out of a special fund.

"The 1913 Act also affects the method whereby an organisation is to prove in courts of law whether it is or is not a Trade Union.

"Thus the fact that a Trade Union is registered is sufficient proof that it is a Trade Union, a privilege which also extends to unregistered unions, which have, by a new procedure inaugurated under this Act, obtained certificates; but otherwise any unregistered society must, in order to show that it is a Trade Union, prove that its principal objects are statutory.

"At the time of writing these notes (Feb., 1923) an attempt is being made to amend the Trade Union Act of 1913 by completely altering the procedure in respect of applications by Trade Union members to be exempted from paying the Political Levy.

"At present the member who desires to be exempt from paying has to apply to the Union for a certificate of exemption. The principle of the proposed amendment is that the person who desires to pay the Levy shall make application for certificate to pay."

Production Costs. Effects of Re-flotation, March, 1923.

Increased cost of all kinds of accessories, coal, and materials, substantial increases in wages rates, increased taxation, increased transportation costs, increased cost of machinery and of repairs to machinery, shorter working hours, increased price of raw cotton; these are important items which have greatly increased the price at which cotton yarn or cotton cloth can be sold at a profit.

A mill worth £80,000 pre-war is now more usually quoted at not less than £200,000. Assuming such mill to make £10,000 profit in a year, it is quite obvious that the dividend rate on the £80,000 would be more than upon the £200,000. Let it be noted that the net amount of profit in each case is the same but the dividend is not the same. The cost of production in one sense is greater simply because a mill has been recapitalised at a much higher figure, and assuming all the necessary capital has been subscribed, but the possible rate per cent. of dividend is infallibly reduced.

Moreover, if the recapitalisation has meant a great amount of loan money upon which good interest must be paid before dividend is declared, it may be said that this interest adds greatly to cost of production. However, to get at the actual mill production costs, in fairness to management and directors, this factor may be left out for the moment and only added to the costs before a dividend is allocated. A mill might ignore the interest on loan and debts, and say a profit of £10,000 had been made in fair running, but that this is absorbed by loan interest, depreciation, etc.

Increased price of raw cotton certainly adds to cost of production, chiefly because of the greater monetary loss by waste.

A weekly monetary loss of £100 on 10*d.* cotton would be approximately £200 for the same weight of waste from 20*d.* cotton. A weight of 100 lb. total loss by waste from 1*s.* cotton would be doubled in monetary value from 2*s.* cotton, the one being £5 and the other £10.

From its narrowest and possibly its most strictly fair point of view, and totally regardless of whether there is a final profit or loss, or what is paid for loan interest, depreciation or sinking fund, the cost of production might be based on the amount paid for all wages, management, all accessories and stores, machinery and building repairs, coal, loss by waste, rents, rates, taxes, lighting, insurance and generally all expenses which are actually incurred in transforming the raw cotton into finished yarn. Suppose American cotton cost 15*d.* per lb. and it took 6*d.* to make it into yarn, including all such items as above but ignoring such items as capital charges, such as amount of capital invested, depreciation, interest on money and debts. This might be termed actual cost of production, but this might be near the same total for two mills and yet one declare a good dividend and the other none at all, simply because of differences in loan and other interest, or amount per spindle.

Cases have existed of cotton mills really worth £100,000 but not more than £20,000 called up, and the rest loan money at 4 per cent. or 5 per cent. Prosperous times have made such a firm pay very high dividend rates, while other mills producing as cheaply but all paid-up capital have paid a far more modest dividend. Period 1920 to 1923 the absolute reverse has been taking place in scores of mills. Recapitalisation has frequently led to a firm being refloated without all the shares being allotted, and the banks or other people have loaned the money required for the transfer and fresh start.

However low has been the cost of production and however devoted, skilful and clever the management, many such firms have been quite unable to pay any dividend because any actual working profit has had to be paid away in interest.

In spite of adverse criticisms, there are few industries in which those in charge can and do more rapidly and accurately estimate the cost of production per pound of yarn for different sorts and counts within reasonable limits and ranges.

Known productions, speeds, and capacities of machinery, ability to readily judge what certain cottons are likely to do, standardised base prices for work at certain machines, and definitely regulated piece-work rates for such machines as fly-frames and self-actor mules.

Competent foremen and managers can readily judge whether work is being done with sufficient skill, quality and quantity with very little calculation, but a good system of costing and checking productions helps in detecting any weaknesses.

On Manchester Exchange the lowest prices from reliable firms may get the business irrespective of cost of production, which is a matter for the spinner and not the yarn buyer to attend to, especially so when yarns are plentiful.

Combing adds greatly to cost of production, and so also does spinning from double roving at the mule or ring-frame.

It is possible to spin 40's from single roving or from double roving, and either from American or Egyptian cotton, but the roving fed to the final spinning machine must be much finer and much more costly to produce for the double roving than for the single.

The standard spindle gauge for American pin cop is $1\frac{1}{8}$ inch. and for twist $1\frac{3}{8}$ inch., so that twist mules require proportionately more space than the pin cop weft. This adds somewhat to final spinning costs. Also twist or warp yarns require more twist per inch than weft yarns, and increased twist at any machine adds to cost of production.

In the middle of 1921 it was intimated that it took $10\frac{1}{2}d.$ to spin one pound of about 36's twist as against $3{\cdot}3d.$ in 1912, taking American cotton at $10d.$ in each case and loss at $13\frac{1}{2}$ per cent. By the end of 1922 costs had come down again somewhat. Approximate figures were given as below:—

	1912.	1921.
Wages per lb.	$1{\cdot}20d.$	$4{\cdot}50d.$
Expenses	$1{\cdot}25d.$	$5{\cdot}25d.$
Discount	$0{\cdot}39d.$	$0{\cdot}57d.$

Short time adds distinctly to cost of production because there are so many standing or overhead charges remaining more or less the same and to be spread over a proportionately reduced production.

Rents, rates, taxes, insurance, heating, management expenses and other such items may be mentioned for example.

Level business and dividends—as distinct from great variations

—are more likely to result from a greater proportion of share capital and a reduced proportion of loan money.

Tariffs against our cotton yarns and cloths in various parts of the world—both foreign countries and those within the British Empire—have often made it more difficult to do business at a profit.

If America choose to put a charge on raw cotton leaving that country the difficulties would be increased.

Recapitalisation in many cases has spread the shares over a much greater number of individuals, £1 shares having become very general.

Depreciation allowances have always varied considerably with different firms, but for taxation purposes the inland revenue people have prepared fixed rates which make no such distinctions.

Recapitalisation has led to greater allowances for depreciation both on the part of mills themselves and the taxing authorities. A nominal capital of £200,000 is counted proportionately higher for depreciation allowances than a nominal capital of say £80,000.

The enhanced cost of repairs, renewals, new machinery, raw cotton, stocks of bobbins, yarn and other items in the mill have led to much greater charges for insurance, and this naturally adds to cost of production before a profit may be declared. A greater margin between cost of raw cotton and selling price of yarn becomes necessary to declare a profit and dividend. When prices and wages were at their highest during the great post-war boom insurance charges on the same concern were often trebled, quadrupled, or even increased at more than these rates.

In many cases the local rateable values of mills have been doubled and an item like this adds to the margin necessary before a dividend can be declared.

A large amount of loan money has been known to add $\frac{3}{8}d.$ per lb. to the yarn before a dividend could be declared, but it is usually the dividend and not the customs that suffers.

Share capital influences the amount of dividend rather than the internal mill cost of production.

Economics of the Cotton Industry Syllabus, 1923.

(*a*) *The Firm : Its Structure.*

The sole trader, the partnership, the company, limited liability companies, private companies. Reasons for the evolution of these firms of business structure.

Detailed treatment of the company. Memorandum of Association, Articles of Association. The capital of the company, nominal or authorised capital, subscribed capital, called up capital;

various classes of shares; borrowing of money by issue of debentures; "continuous loans" and other financial methods characteristic of the Cotton Trade. Transferability of shares. Calculations in regard to purchase and sale of shares and other securities.

Generalised balance sheet of a company; principal items and their significance.

(*b*) *The Firm: Its Operations.*

Organisation of typical cotton spinning or manufacturing businesses. Capital owned and employed, analysis thereof. Management, directors, departments, managers, foremen or onlookers, etc. Payment of wage-earners. Time wages, piece wages, and their calculation; other methods of paying wages.

Analysis of cost of product. Final cost = factory cost + commercial cost, *i.e.*, prime cost (wages and cost of material) + overhead expenses or "on-cost."

Overhead expenses or "on-cost" = "burden" chargeable to factory (factory "on-cost") + commercial expenses.

(*c*) *The Industry.* (1) *Commercial Organisation.*

Purchase of raw cotton. Liverpool Cotton Exchange: its constitution and functions. Futures. General treatment of speculation.

Purchase and sale of yarn. Organisation thereof.

Purchase and sale of piece goods. Organisation thereof.

The Manchester Royal Exchange: its constitution and functions.

The internal distributive trade in raw cotton, yarn and finished cotton goods.

Manchester shipping houses.

The banking system in relation to dealings in cotton goods as set out above.

(2) *Industrial Structure.*

The branches of the industry and their interrelation.

Spinning.

Manufacturing or weaving.

Finishing processes, bleaching and dyeing, etc.

Combination and specialisation (including geographical specialisation) in relation to the foregoing. Machine making: relation of textile to machine making firms in the cotton industry; transport in relation to the cotton industry.

Amalgamations, combinations, trusts, kartels or cartels, in the

cotton industry at home and abroad; degrees to which various branches of the industry lend themselves to combinations of various kinds and to large scale production.

Organisation—(*a*) of employed—Trade Unions, Craft Unions, Industrial Unions; (*b*) of employers—Masters' Association.

Disputes: their origin, conduct and settlement. Negotiation, conciliation, arbitration. The employee as shareholder. Distinctive features of the cotton industry as to combination amongst employers and employed.

THE END.

INDEX.

A

Abstract of Factory Act, 264.
Agency terms, 90.
Agents and merchants, 168.
Air transport, 336.
Allen seed cotton, 57.
Allowances on cotton, 66.
Alsatian productions, 284.
Amalgamated Operatives' Examinations, 230-240.
Amalgamations, 176.
American cotton, increase of, 289.
— "Extras" cotton, 7.
— view of cotton production, 57-58.
Applications of cotton yarns, 151.
Appreciated values, 94, 103.
Approximate cotton crops, 15.
— spindles, 26.
Arizona cotton, 37.
Arkwright's, period of, 279-280.
Artificial cotton, 155.
Asbestos, 141.
Assignment, 161.
Associate members, 70.
Association powers, 184.
Assuan dam, 17.
Auditing books, 182.
Australian cotton, 314.
Automatic looms, 328.
Average counts, 205.
Averages, 65.

B

Backshaft scrolls, 269.
Bale-book, 41.
Bale-breakers and mixing, 50.
Bales of cotton, types of, 23.
Baling of cotton, 21, 61.
Banking procedure, 160, 165, 170, 179, 336.
Bills of Exchange, 169.
Blackburn twisting list, 322.
Blankets, 130.
Bleaching of cotton, 158.
Blow-room machinery, 265.
Board of Trade report, 199.
Boll-Weevil, 161.
Bolls of cotton, 11.
Bolton spinners' list, 246.
Book-keeping, 167.
Books, departmental, for spinning mill, 100.
— for mill, 183.
— on cotton industry, 301.
British cotton research, 52.
— Empire cotton growing, 52-55.
Brocades, 133.
Brokers, 66, 69.
Business documents, 165.
Buying and selling of cotton yarn, 89.

C

Calculations, 208-212.
"Call" cotton, 75-76.
Cambrics, 132.
Canal, Manchester, 89.
— transport, 291.
Cancelled business, 192.
Cantars, 8, 9.
Carding engine fencing, 266.
Card-room lists, 254.
Card tenters, 255.
Cartels in cotton trade, 165.
Cash statement, 234.
Cellars for damping, 109.
Cheques procedure, 168.
China grass, 148.
Chinese cotton, 58.
C.I.F. cotton, 77-79.
Circular for new mill, 177.
City Guilds examination papers, 271-273, 274-277.
Clauses for spinner's wages, 247.
Cleaning and oiling, 245, 268.
Climate and soil, 43.
Cloth business, 104.
— finishing, 114.
— from cotton waste yarns, 128-129.
— names for, 127-128.

Cloth styles, 130-133.
Coarse counts, 243.
Coloured cotton, 65, 154.
Combers, 256.
Commercial methods, 160.
Companies, 175.
Company articles, 185.
Comparative features of fibres, 141.
Competition against Lancashire, 243.
Conditioning of yarn, 108, 110.
Conditions for spinners, 262-263.
Conference fencing figures, 265.
Contract form, 79.
Contracts in cotton trade, 105-108.
— for " Futures," 83.
Cop packers, 261.
Copyright, 179.
Cost of production and reflotation, 343.
Costings, 190, 203, 204, 208, 216.
— for yarn, 218-219.
Costs, overhead, 222.
Cotton artificial, 155.
— Australian, 314.
— bale-book, 41.
— bale marking, 22.
— baling of, 21, 61.
— blankets, 130.
— bleaching, 158.
— bolls, 11.
— consumption, 27-28.
— control, 8-9.
— crops, 15.
— definition of, 3.
— development abroad, 290.
— dyeing, 152.
— exported formerly, 288.
— exports, 199.
— fibre measurement, 37.
— — testing, 26.
— for different yarns, 51.
— from Africa, 47.
— " Futures," 311.
— ginning, 19.
— grading, 72.
— growing, 1, 286, 313.
— — and rivers, 16.
— hair and cotton wax, 334.
— importing, 64.
— industry, treatise on, 301.
— in former times, 284, 295.
— in the home, 291.
— localities, 5.
— market, 80.
— markets, 13.
— mixing, 48-50.
— names, 6.
— Peruvian, 317.
Cotton picking, 59.
— plants and fibres, 10.
— quotations, 67.
— rotation of crops of,
— selection, 51.
— testing, 34.
— trade, great extent of, 3.
— — 100 years ago, 274-277.
— values, 286.
— waste yarns, 155.
— yarns, applications of, 151.
Counterfoil, 94.
Counts, average, 205.
— of yarn for cloth, 94.
Craft *v.* trade unions, 338-339.
Crop, failure, 46.
Crops, weight of, 239.
Current account, 180.

D

Damage by saw-gin, 45-46.
— to cotton, 287.
Damping cellars, 109.
Dealings in yarn, 99.
Debentures, 200.
Debts, 167.
Defective bales, 312.
Delta in Egypt, 19.
Departmental books, 100.
Depreciation of values, 95, 180.
Deterioration of Egyptian cotton, 47.
Development of cotton trade, 151.
Developments in trade, 278, 289.
Dhooties, 131.
Discount calculation, 215.
Discounts, 26, 182.
Disputes, settlement of, 323.
Docket cotton, 65.
Documents for business, 165.
Dollars per cantar, 9.
Doubled yarns, 225.
Drawing frames, 256, 266.
Duties of mill occupiers, 270.
— — — operatives, 271.
Dyeing of cotton, 152.
— — sliver, 153.
— — yarn, 318.

E

Economics of cotton industry, 345.
Effect of raw cotton price, 211.
— — twist on cost, 229.
Efficiency in mills, 307.
Egyptian bales, 23.
— cotton and canals, 19.
— — developments, 290.

Egyptian cotton and foreign matter, 15.
— — lands, 315.
— — report, 183.
— — spindles, 26.
— fine cotton division, 7.
— " Futures," 304.
Empire cotton growing, 52.
End scrolls, 270.
Exchange, bills of, 169.
— Liverpool, 63.
— Manchester, 86.
Extended cotton growing, 42.
Extras, American cotton, 7.

F

Fabric gloves, 196.
Fancy yarns, 136.
Fan-hole dust, 15.
Fatigue in cotton mills, 84, 307.
Faults in woven fabrics, 331.
Features of cotton yarn, 124.
Fencing clause, 265.
Fibre, uses of, 159.
Fibres, to distinguish, 142-143.
Final baling of cotton, 24.
Fine spinning, 83.
Finisher's triumph, 149.
" Firm " offer, 161.
Flannelettes, 129.
Flax, 140.
Foreign matter in cotton, 15.
— names for cotton, 285.
— trade, 97.
Forwarding, 161.
" Franco," 160.
" Futures " conditions, 311.
— contracts, 83.
— expressions, 81.
— tendered, 80.
— transactions, 82.

G

Gassed yarns, 225.
Ginning of cotton, 19, 44, 46, 287.
Gloves, fabric, 196.
Grading of cotton, 72.
Grandrelle yarns, 154.
Great extent of cotton trade, 3.
Grinders for cards, 255, 260.
Growing of cotton, 1.

H

Hard and soft cottons, 44.
Hard and soft spun yarns, 243.
Hargreaves' jenny, 292.
Heilmann combers, 256.
Hemp, 140.
High-priced cottons, 217.
Hoists in mills, 169.
Hosiery products, 121, 218.
— yarns, 125, 155.

I

Ideal cotton fibres, 43.
Importing of cotton, 64.
Increase of American cotton, 289.
Indian bales, 23.
— cotton, 55-57.
Indicator payment, 214, 283, 246, 250.
Indicators, 190-191.
Industrial research, 84.
Influence of rivers on cotton, 16.
Interest, 182, 210.
Intermediate frames, 258.
Inventors, 293-294, 300-301.
Invoice, 174.

J

Jack frames, 258.
Jaconettes, 132.
Jute fibre, 140.

K

Kinds of yarns, 136.
Knitted goods, 85.

L

Lantern slide testing of cotton, 38.
Lastings cloth, 199.
Light and shade for cotton, 71.
Limited liability, 163.
Limits of association powers, 184.
Liverpool brokers, 66.
— Exchange, 63.
Loan money, safety of, 186, 189, 200, 326.
Localities for cotton growing, 5.
Loco, 179.
London and Exchange rates, 192.
" Longs " and " Shorts " in trade, 334.
Looms and spindles, 135.
— automatic, 328.

M

Machinery making, 200-201, 296-297.
Manchester Exchange, 86, 114.

Manchester railway facilities, 88.
— Ship Canal, 89.
— shipping houses, 173.
— Yarn Conference, 102.
Market expressions, 81.
— procedure, 98, 114, 121.
Markets and ports for cotton, 13, 80.
Markings of cotton bales, 22.
Meade cotton, 31.
Mechanical cotton picking, 59.
— measurement of fibres, 30.
Mercerising, 111, 112, 156, 157.
Method of cotton selection, 71.
Metric system, 119.
Microscopical investigation, 39.
Mildew, 84.
Mill books, 183.
— hoists, 268.
— shares, 187, 189.
— standardisation, 37.
Mixed orders, 95.
— sorts, 96.
Mixing of cottons, 47, 49.
Mixtures of wool and cotton, 145-146.
Mohair, 84.
Moisture test, 40, 66.
Monsoon, 223.
Montgomery quotations, 333.
Mosquito net, 84.
Motor transport, 97, 227.
— tyre covers, 198.
Mule indicators, 246, 250.
— production calculations, 233.

N

Names of cloths, 127.
— — cotton, 6, 73-74, 285-286.
Nasmith comber, 256.
New mill circular, 177.

O

Occupier's duties, 270.
Oiling and cleaning, 245.
Oldham indicators, 250.
— spinners' list, 251.
Opening of cotton bales, 337.
Operative spinners' report, 337.
Operatives and spindles, 302.
Order book, 100.
Origin of cotton, 1.
Original spinning mills, 299.
Overhead costs, 223.

P

Packers of cops, 261.
Packing of cotton bales, 36, 44.
Paper yarn, 144, 147.
Partnerships, 162.
Patents list, 300.
Payment expressions, 178.
— for roller motion, 254.
Payments for yarn, 93.
Peruvian cotton, 317.
Plain doubled yarns, 225.
Ports and markets, 13.
Pre-war costs, 227.
Price of yarns, 114, 117.
— per pound, 295.
— — tooth change, 249.
Prices and costs, 228.
Prime costs, 164.
Principles of cotton treatment, 292.
Printer's cloth, 132.
Productions in former times, 281-283.
Products of fine spinning, 83.
Profit by slack time, 149.
Progress in cotton trade, 59.
Properties of cotton fibres, 11.

Q

Queensland cotton, 54, 134.
Quick-speed clause, 253.
Quilts, 129.

R

Railway carriage cloths, 129.
— facilities, 88.
Rain and insect damage to cotton, 287.
Ramie, 141.
Raw cotton supply, 308.
Recapitalisation, 195, 196, 221.
Reeled yarn standard, 242.
Reports, weekly, 120, 121.
Requirements of yarn sales, 116.
Research in cotton, 52, 310.
— on fatigue in mills, 84.
Ribbon lap machines, 256.
Ring yarn, 137.
Rise of cotton industry, 162.
Rivers and cotton growing, 16.
Road transport, 120.
Roller drawing, 292.
Roving frames, 258.

S

Sale conditions of cotton, 67.
Sales of yarn, 93, 116, 117.

Sampling of bales, 40.
Scrolls on backshafts, 269, 270.
Secretarial examinations, 230-240.
Seed cotton, 288.
Selection of cotton, 51, 70, 71.
Self-acting mules, 267-268.
Sewing cotton, 85.
Share transfers, 185.
Shares for contractors, 176.
— in mills, 187, 189.
Silk, 140.
Sheetings, 133.
Ship Canal, 89.
Shipping houses, 173.
Slave population, 289.
Sliver dyeing, 153.
Slubbing frames, 257.
Soft places in yarns, 111, 113, 124.
Sortings of cotton fibres, 31-34.
Special orders, 98.
— yarns, 136.
Speed clause, 253.
— frames, fencing of, 266.
— standard, 244.
Spindles and looms, 135.
— — operatives, 302.
Spinners' lists, 246, 254.
Standardisation of mills, 37.
Steam wagons, 161.
Straddle, the, 81.
Strength of cotton fibres, 61.
Strengths of yarn, 91.
Strikes, 280.
Strippers and grinders, 255.
Stocktaking, 167.
Styles of cloth, 130-134.
Suez Canal, 18.
Summary of card-room list, 254.
Supplementary clauses, 260.
Supply of cotton, 303.

T

Tables for cotton, woollen, and silk, 155-156, 239.
Tanguis cotton, 317.
Tariffs, 198.
Terms and names for cotton, 73-74.
— for yarn sales, 213, 214.
— of cotton purchase, 70.
Testing of cotton fibres, 26.
Textile companies, 160.
— fibres, other, 138, 141, 159.
— journals, 202.
Total cotton crops, 73.
Towels, 129.
— Turkish, 326.
Trade developments, 151.
— districts *v.* trade terms, 328-329.
— mark, 178.
— report, 199.
— unions, 184, 338-341.
Transactions in "Futures," 82.
Transport by air, 336.
— — canal, 291.
— — motor, 97, 120, 227.
Tubing prices, 244-245.
Turkish towels, 326.
Twist in cotton fibres, 39.
— — yarns, 240, 261.
— standards, 240, 242.

U

Uganda cotton, 47.
Uniform weaving list, 319.
United States, cotton growing in, 289.

V

Values, appreciated, 94, 193.
— of cotton, 286.
Velveteens, 133.
Velvets, 112.

W

Wages 192, 205, 207.
— calculations, 230-240.
Wagons, steam, 161.
Waste yarns in cloths, 128.
Watt's engines, 299.
Weather reports, 183, 304.
Weaving list, uniform, 319.
— mill systems, 133-134, 325.
Weekly reports, 120, 121.
Weevil, 61.
Weight of cops, 239.
Welfare work, 284, 305.
West African cotton, 47.
Winding prices, 321.
Wool *v.* worsted, 140, 150.
World's cotton consumption, 303.
Woven belting, 308.

Y

Yarn buying and selling, 89.
— conditioning, 108.
— dealings, notes on, 99.
— deliveries, 173.

LIBRARY.

Yarn payments, 93.
— prices, 114, 117.
— quotations, 69.
— sale conditions, 102.
— — terms, 213, 214.
— sales, 93, 118.
— strengths of, 91.
— transactions, 101, 107.
Yarns, fancy, 136-137.
— for certain cloths, 110.
— — specified purposes, 156.
— from paper, 144, 147.
— soft places in, 111, 113, 124.
— thick places in, 125.
— uses of, 123, 124, 126.

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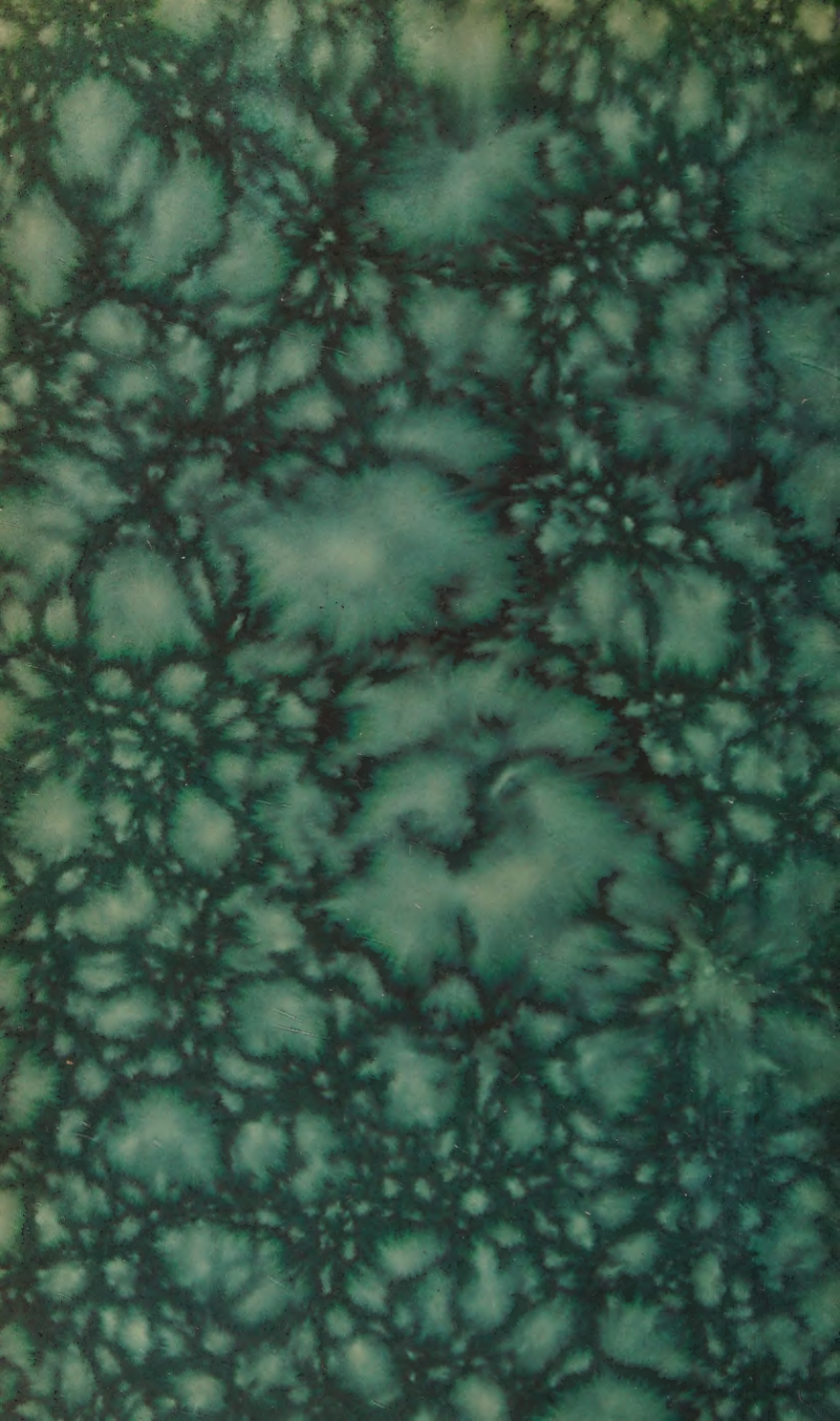

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